



Repair Manual

Jetta 2011 ➤

Jetta 2015 ➤

Engine Mechanical, Fuel Injection and Ignition

Engine ID	CBP A	CKJA							
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Edition 12.2015



List of Workshop Manual Repair Groups

Repair Group

- 00 - General, Technical Data
- 10 - Engine Assembly
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- 15 - Cylinder Head, Valvetrain
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- 24 - Multiport Fuel Injection
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Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.



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00 – General, Technical Data

1 Safety Precautions

(Edition 12.2015)

⇒ [“1.1 Safety Precautions, Working on Fuel Supply System”, page 1](#)

⇒ [“1.2 Road Test with Testing Equipment Safety Precautions”, page 2](#)

⇒ [“1.3 Ignition System Safety Precautions”, page 2](#)

⇒ [“1.4 Cooling System Safety Precautions”, page 3](#)

1.1 Safety Precautions, Working on Fuel Supply System



Caution

For all repair work, especially in the engine compartment due to the tight working conditions, the following must be observed:

- ◆ *Route lines of all types for example for fuel, coolant and refrigerant, vacuum and electrical wires so that the original wiring guide is followed.*
- ◆ *To prevent damage to the lines, make sure there is sufficient clearance to all moving or hot components.*

Always observe the following when removing and installing the Fuel Level Sensor - G- or the fuel pump from full or partially filled fuel tanks.

Remove the fuel pump fuse. For the fuse assignment. Refer to ⇒ Wiring diagrams, Troubleshooting & Component locations.



WARNING

Fuel system is under pressure! Wear eye protection and safety gloves in order to avoid injuries and skin contact. Wrap a cloth around the connection before loosening hose connections. Remove the hose connection carefully to release the pressure.

- ◆ Right before starting work, switch the exhaust extraction system on and place an extraction hose close to the fuel tank installation opening to extract fuel fumes. If no exhaust extraction system is available, a radial fan (as long as motor is not in air flow) with a displacement greater than 15 m³/h can be used.
- ◆ Do not let fuel come in contact with bare skin. Wear fuel-resistant gloves.
- ◆ The Engine Control Module - J623- is equipped with On Board Diagnostics (OBD). Before repairs such as fault finding, check the DTC memory first. Also the vacuum hoses and connections must be checked (unmetered air).
- ◆ The fuel hoses on the engine may only be secured with spring clamps according to the Parts Catalog. The use of clamp or screw type clips is not permissible.



- ◆ Ignition must be switched off when disconnecting the battery. If a coded radio is equipped, the code must be requested before disconnecting the battery.
- ◆ Follow all steps after connecting the battery. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery, Disconnecting and Connecting .
- ◆ For proper function of the electrical components, a voltage of at least 11.5 V is required.
- ◆ Do not use sealants containing silicone. Particles of silicone drawn into the engine, will not be burnt in the engine and damage the oxygen sensor.
- ◆ If the engine only starts briefly and then turns off again after troubleshooting, repairs or checking the components, it may be that the immobilizer is blocking the engine control module. Control module must then be adapted if necessary.
- ◆ It is possible that the control module will recognize a malfunction and store a DTC during some tests. Therefore after completing all checks and repairs, the DTC memory must be checked and if necessary erased.
- ◆ Vehicles with an airbag are equipped with an emergency fuel shut-off system. It reduces the risk of fire in an accident because the fuel pump relay switches the fuel pump off.
- ◆ When the driver-side door is opened, the fuel pump is activated for 2 seconds so that pressure builds in the fuel system. This improves comfort of engine start-up behavior.

1.2 Road Test with Testing Equipment Safety Precautions

There is a Risk of Injury Due to Unsecured Testing Equipment.

If the front passenger airbag activates during an accident unsecured testing equipment becomes a dangerous projectile.

- Secure testing equipment on the rear seat.
- or
- Have a second person operate testing equipment on the rear seat.

1.3 Ignition System Safety Precautions

To avoid the risk of personal injury and/or damage to the fuel injection and ignition system, always observe the following:

- ◆ Do not touch or remove ignition wires when engine is running or turning at starter speed.
- ◆ Only disconnect and reconnect wires for injection and ignition system, including test leads, if ignition is turned off.

If testing equipment is needed on road tests, observe the following:

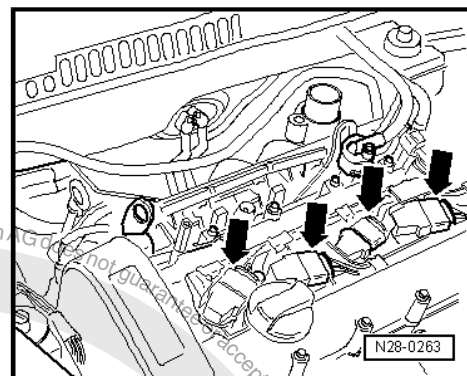
- ◆ The test and measuring instruments must always be secured to the rear seat and operated by a second person from this location.

If the vehicle is involved in a collision while testing and measuring equipment is operated from the front passenger seat, the person sitting in that seat could be seriously injured when the airbag deploys.

- ◆ If engine is to be cranked at starting RPM without starting:



- Disconnect all 4-pin connectors -arrows- from the ignition coil with power output stage.
- Remove the fuse for the Fuel Pump Control Module - J538- from the fuse panel. For the fuse assignment. Refer to ⇒ Wiring diagrams, Troubleshooting & Component locations.



1.4 Cooling System Safety Precautions

There is a Risk of Burns from Hot Coolant.

The coolant system is under pressure when the engine is warm. Risk of scalding due to hot steam and hot coolant.

- Wear safety gloves.
- Wear protective eyewear.
- Reduce the pressure: cover the coolant reservoir cap with a cloth and carefully open.



2 Identification

⇒ **"2.1 Engine Number/Engine Characteristics", page 4**

2.1 Engine Number/Engine Characteristics

The engine number ("engine code" and "serial number") are located at the front of the engine/transmission joint.

The engine number consists of up to nine alphanumeric characters. If more than 999,999 engines with the same engine code are produced, the first of the six characters is replaced with a letter.

The first three letters are the "engine code".

The next six digits are the "serial engine number".

If more than 999,999 engines with the same engine code are produced, the first of the six characters is replaced with a letter.

There is also a label -arrow- on the toothed belt guard that shows the "engine code and the engine serial number".

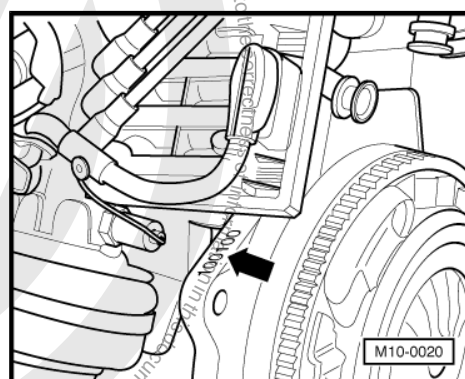
The engine code is also listed on the vehicle data label.

The vehicle data label is located either inside the spare wheel well or on the luggage compartment floor panel.

The vehicle data label is also attached inside the customer Maintenance booklet.

Vehicles with a Four-Digit Engine Code

- ◆ Four-digit engine codes beginning with "C" are used.
- ◆ The first three digits describe the mechanical structure of the engine and are still stamped on the engine, as before.
- ◆ The fourth digit describes the engine output and torque and depends on the Engine Control Module - J623- .
- ◆ The 4-letter engine code can be found on the type plate and on the vehicle data label. It is also stored in the Engine Control Module - J623- .



Code Letters	CBPA	CKJA
Manufactured	From 06/2010	From 12/2010
Emission values in accordance with	ULEV 2 ¹⁾	Level V ²⁾
Displacement liter	2.0	2.0
Output kW at RPM	85/5200	88/5200 ³⁾ 85/5200 ⁴⁾
Torque Nm at RPM	170/4000	180/2250 ³⁾ 174/2250 ⁴⁾
Bore diameter in mm	82.5	82.5
Stroke mm	92.8	92.8
Compression ratio	10.3:1	11.5:1
Valves per cylinder	2	2
RON minimum	95 RON or 91 ROZ unleaded	Alcohol or 87 ROZ unleaded
Fuel injection	Motronic ME 17	Motronic ME 7.5.30
Ignition	Motronic ME 17	Motronic ME 7.5.30



Code Letters	CBPA	CKJA
Knock control	Knock Sensor 1	Knock Sensor 1
OBD	OBDII	OBDII
Oxygen sensor regulation	2 sensors	1 sensor
Catalytic Converter	yes	Yes
Turbocharger	no	no
Secondary Air Injection System	no	no
Variable intake manifold	no	no
Camshaft adjustment	no	no

1) ULEV 2: Ultra Low Emission Vehicles 2

2) According to resolution No. 15, dated 13 .December, 1995 from Conama

3) With the use of alcohol

4) With the use 87 RON unleaded



3 Repair Information

⇒ **"3.1 Clean Working Conditions", page 6**

⇒ **"3.2 Engine Contaminants", page 6**

⇒ **"3.3 Contact Corrosion", page 6**

⇒ **"3.4 Wire Routing and Securing", page 6**

⇒ **"3.5 Cooler and Condenser Assembly", page 6**

3.1 Clean Working Conditions

When working on the fuel supply/injection system, pay careful attention to the following "5 rules" of cleanliness:

- ◆ Thoroughly clean the connecting points and the surrounding area before loosening.
- ◆ Place the removed parts on a clean surface and cover them. Only use lint-free cloths!
- ◆ Carefully cover or seal opened components if the repair will not be done immediately.
- ◆ Install only clean parts: Remove the replacement parts from their packaging just before installing them. Do not use parts that have been stored loose (for example, in tool boxes etc.).
- ◆ If the system is open: do not work with compressed air. Do not move vehicle.

3.2 Engine Contaminants

- ◆ To prevent foreign objects from entering when working on the engine, seal open intake and exhaust channels with suitable plugs, for example from the Engine Bung Set - VAS6122.

3.3 Contact Corrosion

Contact corrosion can occur if incorrect fasteners (bolts, nuts, washers, etc.) are used.

For this reason, only fasteners with a special surface coating are installed.

In addition, rubber or plastic parts and adhesives are made of non-conductive materials.

If there are doubts about whether the parts are suitable, then use new parts. Refer to the Parts Catalog.

3.4 Wire Routing and Securing

- ◆ Mark the individual fuel and vacuum lines for the EVAP canister system as well as the electrical wires before disconnecting and/or removing them. This will prevent a mix-up when reconnecting them. If necessary, draw sketches or take pictures.
- ◆ Due to the limited space inside the engine compartment, be especially careful when working near moving or hot parts to avoid damaging the lines.

3.5 Cooler and Condenser Assembly

When assembled correctly, the radiator, condenser and turbo-charger may have slight impressions on their fins. It is not damage. Do not replace the cooler, condenser or turbocharger because of impressions like that.



10 – Engine Assembly

1 Engine, Removing and Installing

⇒ [“1.1 Engine, Removing”, page 7](#)

⇒ [“1.2 Engine, Securing on Engine and Transmission Holder”, page 12](#)

⇒ [“1.3 Engine, Installing”, page 13](#)

1.1 Engine, Removing

Special tools and workshop equipment required

- ◆ Engine Sling - 2024A-
- ◆ Engine/Trans. Support - T10012-
- ◆ Holding Fixture - VW313-
- ◆ Holding Fixture - VW540-
- ◆ Shop Crane - VAG1202A- or Shop Crane - VAS6100-
- ◆ Instrument/Gauge Tester - VAG1306- or Shop Crane - Drip Tray - VAS6208-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Torque Wrench 1332 40-200Nm - VAG1332-
- ◆ Engine and Gearbox Jack - VAS6931
- ◆ Hose Clip Pliers - VAS5024A-
- ◆ Holding Fixture - Spacers - VW540/1B-
- ◆ Lubricating Grease - G 000 100- (vehicles with manual transmission)
- ◆ Commercially available step ladder
- ◆ Hose Clamps - Up To 25 mm - 3094-

Perform the Following Work

- Check the DTC memory for all control modules with the Vehicle Diagnostic Tester before removing.



Note

- ◆ *To perform work sequence, the ground cable must be disconnected from battery. Check if a coded radio is installed. Get the anti-theft code beforehand, if necessary.*
- ◆ *The engine is removed downward together with the transmission.*
- ◆ *All cable ties, which are opened or cut open when removing the engine, must be replaced in the same position when installing the engine.*
- ◆ *Seal off the disconnected fuel and ventilation lines to prevent dirt from getting into the system.*
- ◆ *Leave the key in the ignition lock. This prevents the steering lock from engaging.*

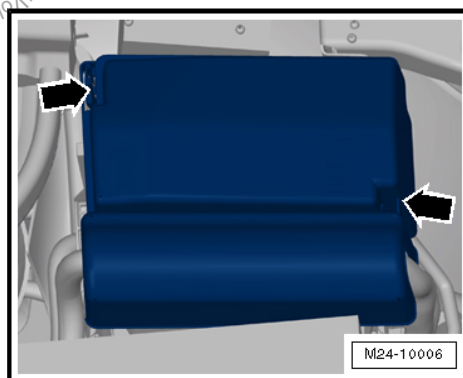
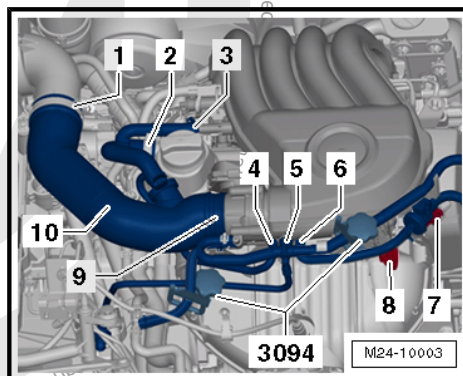


Caution

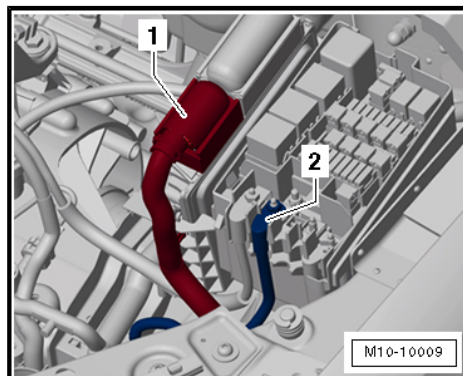
For all repair work, especially in the engine compartment due to the tight working conditions, observe the following:

- ◆ **Route all lines and wires in their original locations.**
- ◆ **Ensure sufficient clearance to all moving or hot components.**

- Open clamps -1, 2, 3 and 9- and remove intake hose -10-.
- Remove the brake booster vacuum hose -5- from the intake manifold.
- Remove the air filter. Refer to
⇒ ["3.1 Overview - Air Filter Housing", page 127](#) .
- Remove the battery and the battery tray. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery Tray, Removing and Installing .
- Drain the coolant. Refer to
⇒ ["1.4 Coolant, Draining and Filling", page 101](#) .
- Remove the E-box cover inside the engine compartment -arrows-.



- Disconnect the line -2- and free it up.
- Disconnect the connector -1- from the engine control module and free up the engine wiring harness. Refer to
⇒ ["6.1 Engine Control Module, Removing and Installing", page 136](#) .

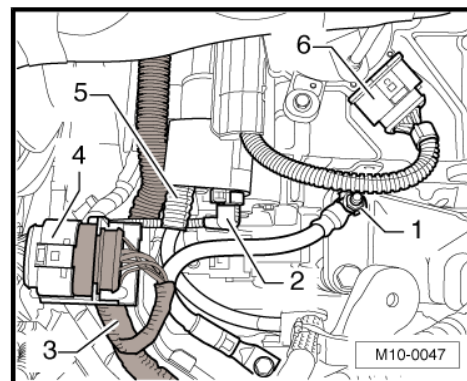




- Disconnect the connector -4-, open the locking mechanism and lay the engine wiring harness -3- on the engine.
- Disconnect the ground cable -1- and the starter connections -2 and 5-.

Vehicles with an Automatic Transmission

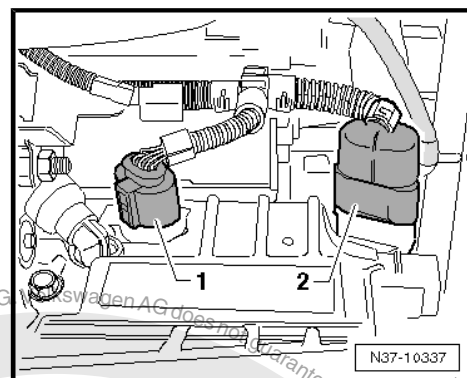
- Disconnect the connector -6- from the multifunction switch.
- Remove the selector lever cable from the transmission. Refer to ⇒ Rep. Gr. 37 ; Selector Mechanism; Selector Mechanism, Removing and Installing .



- Disconnect the connectors -1 and 2- from the transmission.

Vehicles with a Manual Transmission

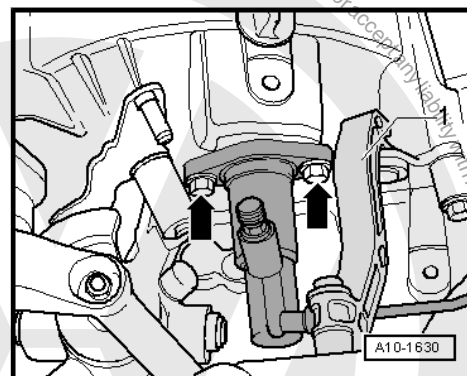
- Remove the gearshift mechanism from the transmission. Refer to ⇒ Manual Transmission; Rep. Gr. 34 ; Shift Mechanism, Servicing; Overview - Operating Cables .



- Remove the brace -1-.
- Remove the clutch slave cylinder -arrows- and lay it to the side. To not open the line system.

Caution

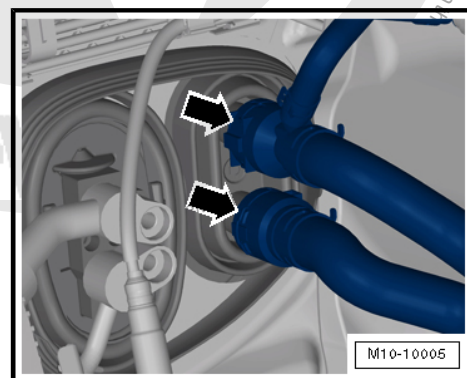
Do not press the clutch pedal after removing the slave cylinder. Slave cylinder may be damaged by doing this.



- Disconnect connector for back-up light switch from transmission.

Continuation for All Vehicles

- Disconnect the connector for the Heated Oxygen Sensor - G39- on the bulkhead -item 14- ⇒ [Item 14 \(page 119\)](#) and free up the wiring harness.
- Remove the coolant hoses from the heat exchanger -arrows-.





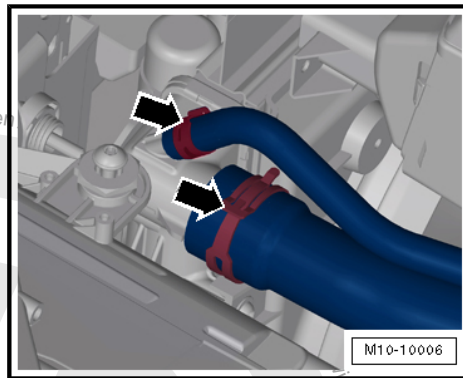
- Open the spring clamps -arrows- and remove the coolant hoses from the radiator.
- Disconnect the coolant hoses from the coolant reservoir.
- Remove the air shroud with the radiator fans. Refer to ⇒ ["3.3 Coolant Fan V7 and Coolant Fan 2 V177, Removing and Installing", page 114](#).



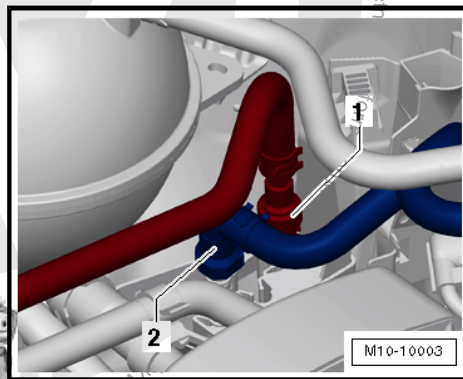
WARNING

Fuel system is under pressure!

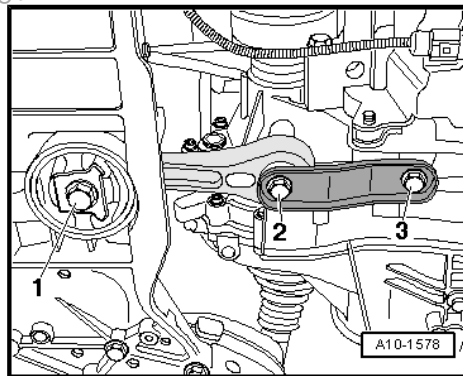
- ◆ **Wear protective eyewear and protective clothing in order to avoid injury and contact with the skin.**
- ◆ **Wrap a cloth around the wiring connections before loosening hose connections. Then release pressure by carefully pulling off the line.**



- Disconnect the fuel supply line -1-. Push the locking ring upward and into the housing.
- Disconnect the breather line -2-. Press the locking ring.
- Seal the lines so that the fuel system is not contaminated by dirt etc.
- Remove the front exhaust pipe. Refer to ⇒ ["2.1 Overview - Emissions Control", page 147](#).
- Remove the right drive axle. Refer to ⇒ Suspension, Wheels, Steering; Rep. Gr. 40 ; Drive Axle; Drive Axle, Removing and Installing .
- Remove the left drive axle from the transmission and tie it up.



- Remove the bolt -1-.
- Remove the bolts -2 and 3-.
- Remove the pendulum support.
- Remove the ribbed belt. Refer to ⇒ ["1.2 Ribbed Belt, Removing and Installing", page 31](#).
- Remove the clamps for the power steering pressure line on the transmission. Refer to ⇒ Suspension, Wheels, Steering; Rep. Gr. 48 ; Power Steering Hydraulics; Overview - Hydraulic Lines and Reservoir .
- Remove the power steering pump from the auxiliary components bracket and move it forward. Refer to ⇒ Suspension, Wheels, Steering; Rep. Gr. 48 ; Power Steering Hydraulics; Power Steering Pump, Removing and Installing .
- The power steering pressure line remains connected to the power steering pump.
- Remove the bolt -3- and the ribbed belt tensioning damper -2-.
- Remove the third bolt from the power steering fluid reservoir bracket (not illustrated).



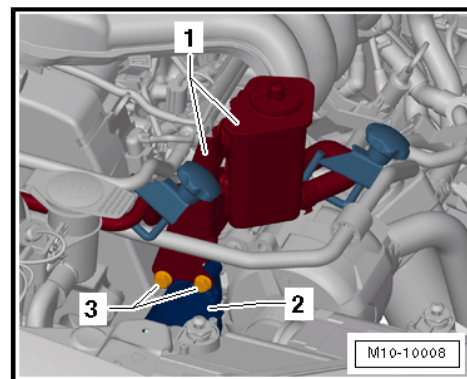


- Move the power steering fluid reservoir, with the hoses -1- and bracket still connected, to the side.

Vehicles with A/C System

- Remove the A/C compressor with the refrigerant hoses still connected from the sub-assembly bracket.

Continuation for All Vehicles

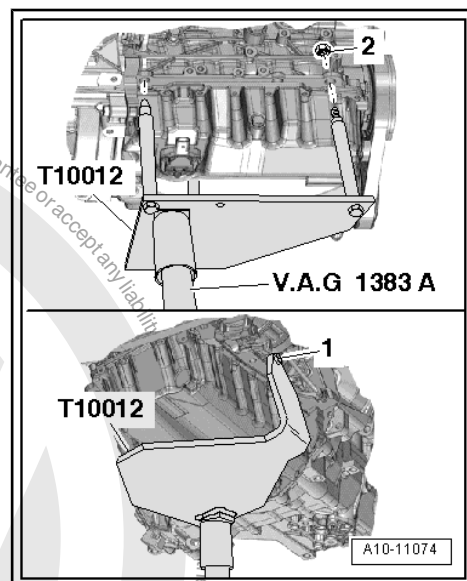


- Place the -T10012- in the -VAS6931- .
- Attach the -T10012- to the cylinder block. Tighten the nut -2- and the bolt -1- to 20 Nm.
- Insert the -VAS6931- into the -T10012- .
- Lift the engine and transmission gently using the -VAS6931- .

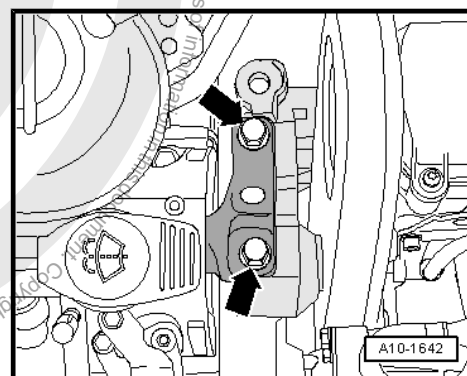


WARNING

Use a commercially available step ladder when removing the bolts on the engine/transmission mount.



- Remove the engine mount from the engine support from the top -arrows-.



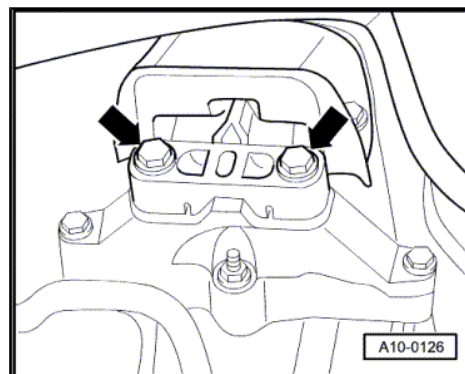


- Remove the transmission mount from the transmission holder -arrows-.



Note

- ◆ Check that all hoses and lines between engine/transmission assembly and body have been disconnected.
- ◆ A second technician is needed to lower the engine/transmission assembly.
- ◆ The engine/transmission assembly must be guided with care to prevent damage while lowering.



- Carefully lower the engine/transmission assembly. When doing this, rotate or push the engine/transmission assembly.

Tightening Specifications

Bolted Connections		Tightening Specifications
Bolts and Nuts	M 6	9 Nm
	M 7	15 Nm
	M 8	23 Nm
	M10	40 Nm
	M12	60 Nm
Exceptions:		
Engine/transmission connecting bolts:		
◆ Refer to ⇒ Manual Transmission; Rep. Gr. 34 ; Transmission, Removing and Installing, Vehicles with Diesel and Gasoline Engines; Tightening Specifications .		
◆ Refer to ⇒ Automatic Transmission; Rep. Gr. 37 ; Transmission, Removing and Installing; Transmission to Engine, Tightening Specifications .		
Converter to drive plate:		
◆ Refer to ⇒ Automatic Transmission; Rep. Gr. 37 ; Transmission, Removing and Installing; Transmission to Engine, Tightening Specifications .		

Tightening Specifications

- ◆ Refer to ⇒ [“2.1 Overview - Subframe Mount”, page 17](#)

1.2 Engine, Securing on Engine and Transmission Holder

Special tools and workshop equipment required

- ◆ Holding Fixture - VW313-
- ◆ Holding Fixture - VW540-
- ◆ Holding Fixture - Spacers - VW540/1B-
- ◆ Engine Sling - 2024A-
- ◆ Engine and Gearbox Jack - VAS6931-
- ◆ Engine and Transmission Holder - VAS6095-
- ◆ Shop Crane



Perform the Following Work:

To perform the assembly work, secure the engine to the assembly stand -VW313- using the -VW540- and the -VW540/1B- .

Procedure

- Remove the transmission from the engine.

Vehicles with an Automatic Transmission

- Support the torque converter to keep it from “falling down”, after separating the engine from the transmission.

Continuation for All Vehicles



WARNING

Use locking pins at the hooks and drifts so that the engine cannot slip or move.

- Engage the -2024A- as follows and lift it out of the -VAS6931- using the Shop Crane .

Belt pulley side:

- Third hole in the rail with holes in position 2

Transmission side:

- Third hole in the rail with holes in position 8

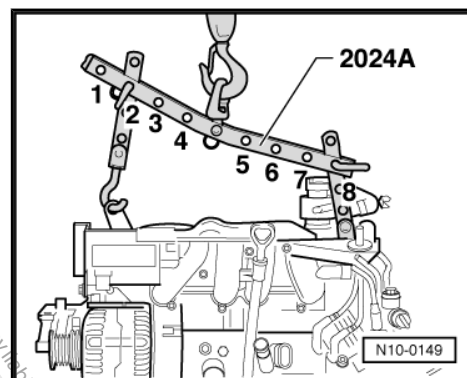


Note

- ◆ *The peg positions on the carrying strap marked 1 to 4 face the belt pulley.*
- ◆ *The bores in the hole rail are counted from the hook.*

Secure the engine using the -VW540- and -VW540/1B- on the -VW313- . Remove the alignment sleeves to do this.

The engine can also be secured to the -VAS6095- .



1.3 Engine, Installing

Perform the Following Work

Install in reverse order of removal. Pay attention to the following:



Caution

For all repair work, especially in the engine compartment due to the tight working conditions, observe the following:

- ◆ *Route all lines and wires in their original locations.*
- ◆ *Ensure sufficient clearance to all moving or hot components.*



Note

- ◆ *During installation, all cable ties must be installed at the same location.*
- ◆ *Secure all hose connections with hose clamps. Refer to the Parts Catalog.*
- ◆ *Use self-locking nuts.*
- ◆ *Replace the bolts, which were tighten with an additional turn.*
- ◆ *Always replace gaskets and seals.*

Vehicles with a Manual Transmission

- Check clutch release bearing for wear and replace if necessary.
- Lightly grease the clutch release bearing, guide sleeve for release bearing and drive axle splines with Grease for Clutch Disc Shaft Splines - G 000 100- .

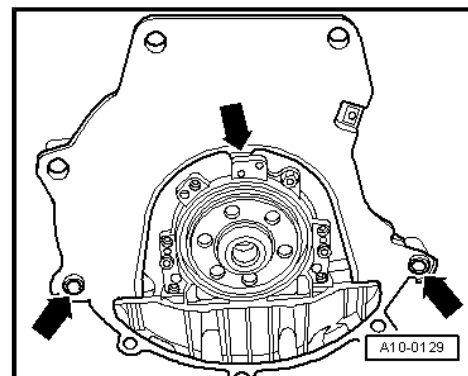
Continuation for All Vehicles

- Make sure the alignment bushings for centering the engine/transmission are installed inside the cylinder block. Install them if necessary.





- Engine the intermediate plate with the sealing flange and then slide it onto the alignment sleeves -arrows-.
- Make sure there is enough clearance for the drive axle when installing the assembly.
- Adjust the subframe mount. Refer to
 ⇒ [“2.4 Subframe Mount, Adjusting”, page 24](#) .
- Install the pendulum support. Refer to
 ⇒ [“2.1 Overview - Subframe Mount”, page 17](#) .
- Install the right drive axle and attach the left drive axle to the transmission. Refer to ⇒ Suspension, Wheels, Steering; Rep. Gr. 40 ; Drive Axle; Drive Axle, Removing and Installing .
- Install the front exhaust pipe. Refer to
 ⇒ [“2.1 Overview - Emissions Control”, page 147](#) .
- Install the A/C compressor. Refer to ⇒ Heating, Ventilation and Air Conditioning; Rep. Gr. 87 ; A/C Compressor; A/C Compressor, Removing and Installing .
- Install the power steering pump. Refer to ⇒ Suspension, Wheels, Steering; Rep. Gr. 48 ; Power Steering Hydraulics; Power Steering Pump, Removing and Installing .
- Install the ribbed belt. Refer to
 ⇒ [“1.2 Ribbed Belt, Removing and Installing”, page 31](#) .



Vehicles with a Manual Transmission

- Install the gearshift mechanism and adjust if necessary. Refer to ⇒ Rep. Gr. 34 ; Shift Mechanism, Servicing .
- Install the hydraulic clutch slave cylinder. Refer to ⇒ Manual Transmission; Rep. Gr. 30 ; Clutch Release Mechanism, Servicing; Clutch Slave Cylinder with Release Bearing, Removing and Installing .

Vehicles with an Automatic Transmission

Install and adjust the selector lever cable. Refer to ⇒ Rep. Gr. 37 ; Selector Mechanism; Selector Mechanism, Removing and Installing .

Continuation for All Vehicles

- Install the battery. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery, Removing and Installing .
- Install the air filter. Refer to
 ⇒ [“3.1 Overview - Air Filter Housing”, page 127](#) .
- Fuel system, bleeding. Refer to
 ⇒ [“1.2 Fuel System, Filling/Bleeding”, page 119](#) .
- Fill with coolant. Refer to
 ⇒ [“1.4 Coolant, Draining and Filling”, page 101](#) .
- Erase the adaptation values and adapt the engine control module to the throttle valve control module see Vehicle Diagnostic Tester “Guided Fault Finding” function.
- Perform a vehicle system test see Vehicle Diagnostic Tester “Guided Fault Finding” function.
- End the vehicle system test in such a way that possibly existing DTC entries are automatically erased.
- Perform a road test.

Follow all safety precautions that apply to road tests. Refer to
 ⇒ [“1.2 Road Test with Testing Equipment Safety Precautions”, page 2](#) .

- Perform the vehicle system test once again.



- Correct any faults.

Tightening Specifications

- ◆ Refer to ⇒ [“2.1 Overview - Subframe Mount”, page 17](#)

Bolted Connections		Tightening Specifications
Bolts and Nuts	M 6	9 Nm
	M 7	15 Nm
	M 8	23 Nm
	M10	40 Nm
	M12	60 Nm
Exceptions:		
Engine/transmission connecting bolts:		
◆ Refer to ⇒ Manual Transmission; Rep. Gr. 34 ; Transmission, Removing and Installing; Vehicles with Diesel and Gasoline Engines; Tightening Specifications .		
◆ Refer to ⇒ Automatic Transmission; Rep. Gr. 37 ; Transmission, Removing and Installing; Transmission to Engine, Tightening Specifications .		
Converter to drive plate:		
◆ Refer to ⇒ Automatic Transmission; Rep. Gr. 37 ; Transmission, Removing and Installing; Transmission to Engine, Tightening Specifications .		



2 Subframe Mount

⇒ [“2.1 Overview - Subframe Mount”, page 17](#)

⇒ [“2.2 Engine Mount, Removing and Installing”, page 17](#)

⇒ [“2.3 Engine, Supporting in Installed Position”, page 21](#)

⇒ [“2.4 Subframe Mount, Adjusting”, page 24](#)

⇒ [“2.5 Subframe Mount, Checking Adjustment”, page 25](#)

2.1 Overview - Subframe Mount



Note

The subframe mount bolts (expansion bolts) must be replaced.

Tightening Specifications

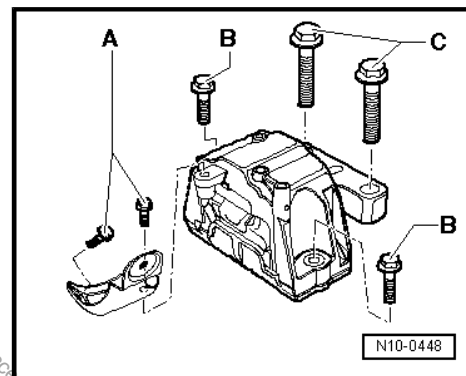
Subframe Mount, Engine

A ¹⁾ = 20 Nm +90°

B ¹⁾ = 40 Nm +90°

C ¹⁾ = 60 Nm +90°

¹⁾ Replace after removing

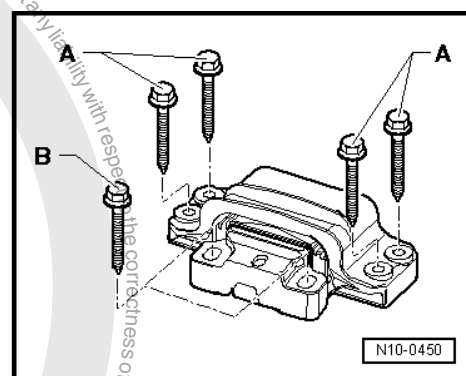


Subframe Mount, Transmission

A ¹⁾ = 40 Nm +90°

B ¹⁾ = 60 Nm +90°

¹⁾ Replace after removing



Pendulum Support

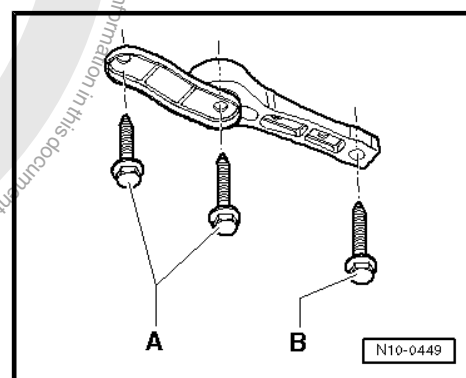
A ¹⁾ = 40 Nm +90°

B ¹⁾ = 100 Nm +90°

¹⁾ Replace after removing

Remove the pendulum support: First bolt -B-, then bolts -A-.

Install the pendulum support: Tighten bolts -A- first, then bolt -B-.



2.2 Engine Mount, Removing and Installing

Special tools and workshop equipment required



- ◆ Engine Support Bridge - 10-222A-
- ◆ Engine Support Bridge - Spindle - 10-222A/11-
- ◆ Engine Support Bridge - Engine Support 28 - 10-222A/28-
- ◆ Engine Support Bridge - Engine Support 31 - 10-222A/31-
- ◆ Rail with Holes - T40091/2- from the Engine Support - Basic Set - T40091-
- ◆ Mount - T40093/5- from the Engine Support - Supplement Kit - T40093A-
- ◆ Engine Support Bridge - Engine Support 28-2 - 10-222A/28-2- , quantity: 2
- ◆ Square Pipe - T40091/1- (quantity 2) from the Engine Support - Basic Set - T40091-
- ◆ Movable Joint - T40091/3- (quantity 2) from the Engine Support - Basic Set - T40091-
- ◆ Movable Joint - T40093/4- (quantity 2) from the Engine Support - Supplement Kit - T40091-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-

Procedure



Note

Without removing the battery and battery tray

Removing

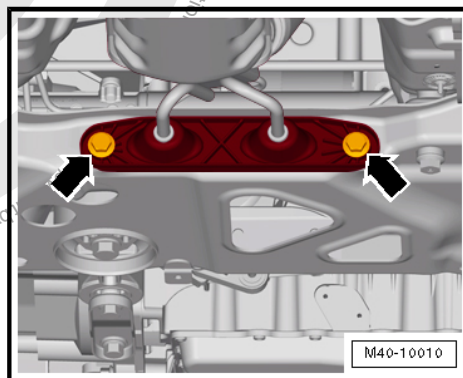


Caution

Danger of causing damage to the decoupling element:

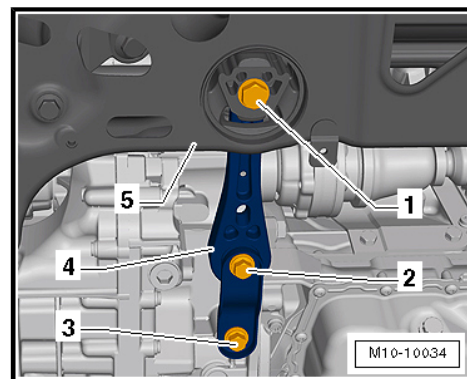
- ◆ ***Do not bend the decoupling element more than 10°.***
- ◆ ***Do not stretch the decoupling element.***
- ◆ ***Do not damage the wire mesh on the decoupling element.***

- Remove the exhaust system bracket from the subframe -arrows-.

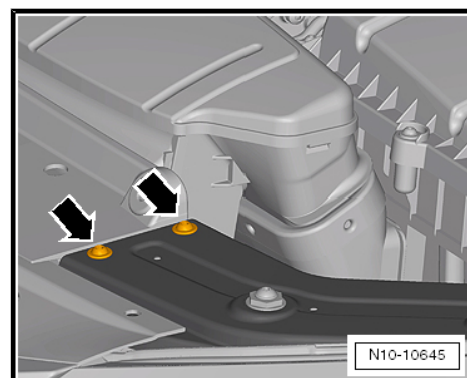




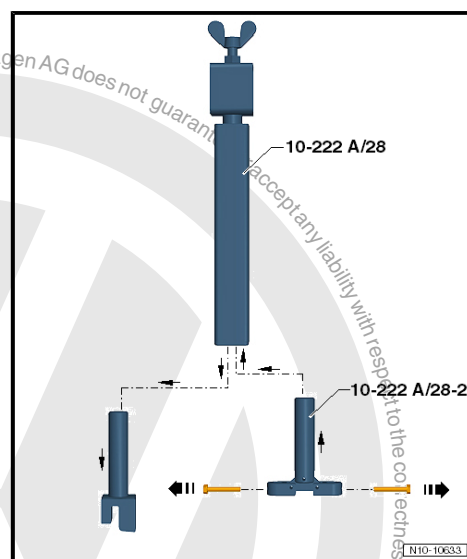
- Remove the bolt -1-.
- Remove the bolts -2 and 3-.
- Remove the pendulum support.
- Remove the plenum chamber cover. Refer to ⇒ Body Exterior; Rep. Gr. 50 ; Bulkhead; Plenum Chamber Cover, Removing and Installing .



- Remove the bolts -arrows- from the left and right sides of the lock carrier bracket.



- Remove the lower mounts on the - 10-222A/28- and replace with the -10-222A/28-2- .
- Remove the bolts -arrows- for securing the engine support bridge on the lock carrier from the -10-222A/28-2- .

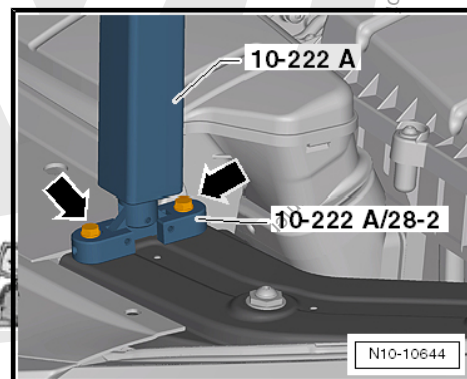


- Use the bolts from the -10-222A/28-2- for attaching the -10-222A/28- . Do not use the bolts for the bracket.
- Bolt tightening specification -arrows-: 8 Nm



Caution

A second technician is needed when positioning the -10-222A- on the vehicle to keep the -10-222A- from tipping.





Mount the engine support bridge on the engine/transmission sub-assembly as follows:

1 - -10-222A/31-2-

2 - -T40091/3-

3 - -10-222A/31-1-

4 - -T40093/4-

5 - -T40091/1-

6 - -10-222A/28- with -10-222A/28-2-

- First slide the -T40093/4- - 2- onto the Square Pipe on the -10-222A- .

• The bolts for the -T40091/3- - 2- on the -10-222A- point in the direction of travel.

- Mount the -10-222A- on the suspension strut domes and have a second technician hold it to prevent it from falling over.

- Slide the -T40091/1- - 5- on the left and right sides through the -10-222A/28- - 6- from the front and position the -T40093/4- - 4- on each side.

- Slide the -T40091/2- - 8- with the -T40093/5- - 7- into the -T40093/4- - 4-.

1 - -10-222A/31-2-

2 - -T40091/3-

3 - -10-222A/31-1-

4 - -T40093/4-

5 - -T40091/1-

6 - -10-222A/28- with -10-222A/28-2-

7 - -T40093/5-

8 - -T40091/2-

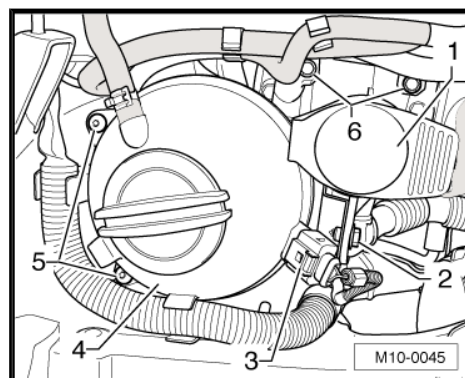
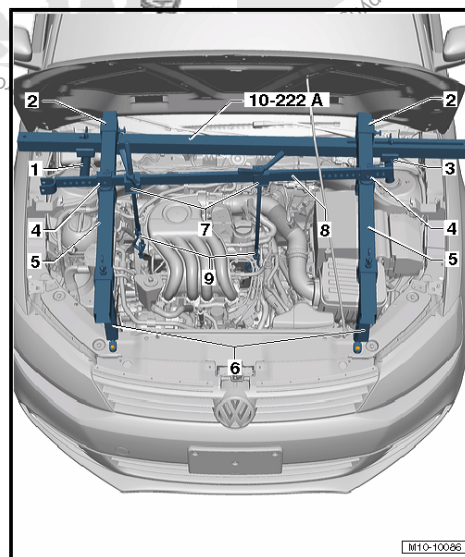
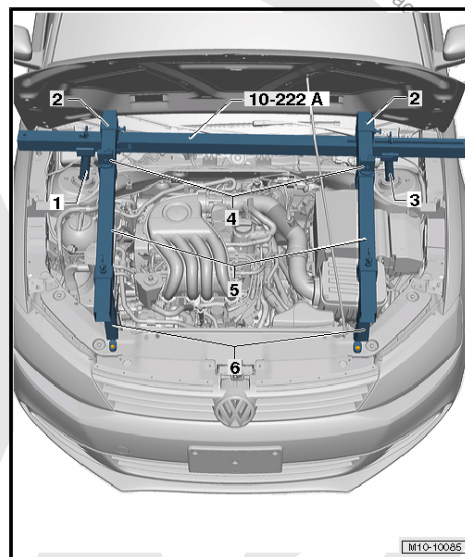
9 - -10-222A/11-

- Insert the securing pin into the -T40091/2- - 8- and secure it with cotter pins.

- Tighten all threaded connections on the -10-222A- hand-tight. While doing so, adjust the height of the -10-222A- parallel over the -10-222A/28- .

- Gently pretension the engine/transmission assembly via the -10-222A/11- -9-, but do not lift.

- Remove the bolt -2- and move the windshield washer fluid reservoir filler tube forward -1-.





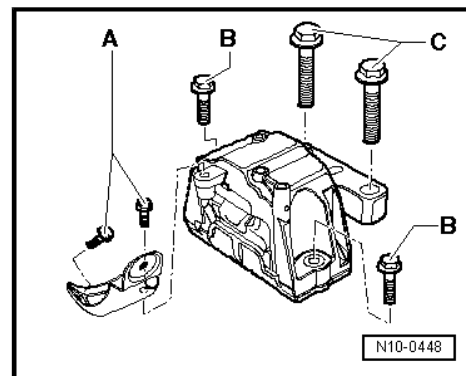
- Remove the bolts -5- and lay the coolant reservoir on the engine, with the hoses still connected.
- Remove the engine mount bolts -A, B and C-; and then remove the engine mount upward.

Installing

Install in reverse order of removal. Pay attention to the following:

Tightening Specifications

- ◆ Refer to ⇒ [“2.1 Overview - Subframe Mount”, page 17](#)
- ◆ Refer to ⇒ [“2.4 Subframe Mount, Adjusting”, page 24](#)



2.3 Engine, Supporting in Installed Position

Special tools and workshop equipment required

- ◆ Engine Support Bridge - 10-222A-
- ◆ Engine Support Bridge - Spindle - 10-222A/11-
- ◆ Engine Support Bridge - Engine Support 28 - 10-222A/28-
- ◆ Engine Support Bridge - Engine Support 31 - 10-222A/31-
- ◆ Rail with Holes - T40091/2- from the Engine Support - Basic Set - T40091-
- ◆ Mount - T40093/5- from the Engine Support - Supplement Kit - T40093A-
- ◆ Engine Support Bridge - Engine Support 28-2 - 10-222A/28-2-, quantity: 2
- ◆ Square Pipe - T40091/1- (quantity 2) from the Engine Support - Basic Set - T40091-
- ◆ Movable Joint - T40091/3- (quantity 2) from the Engine Support - Basic Set - T40091-
- ◆ Movable Joint - T40093/4- (quantity 2) from the Engine Support - Supplement Kit - T40091-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-

Procedure



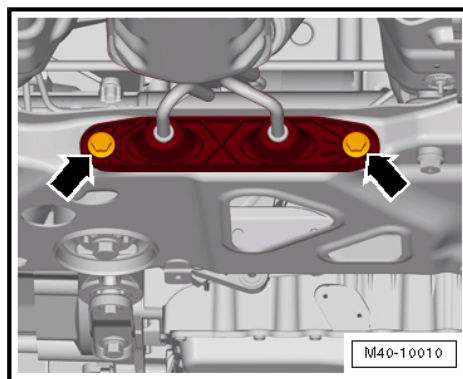
Caution

Danger of causing damage to the decoupling element:

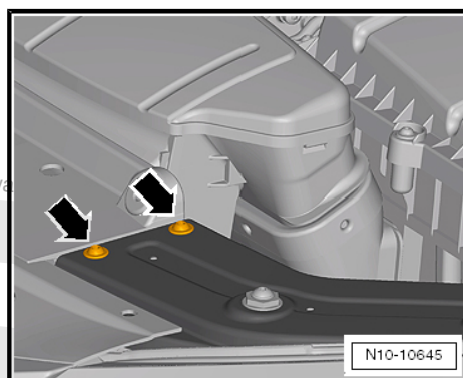
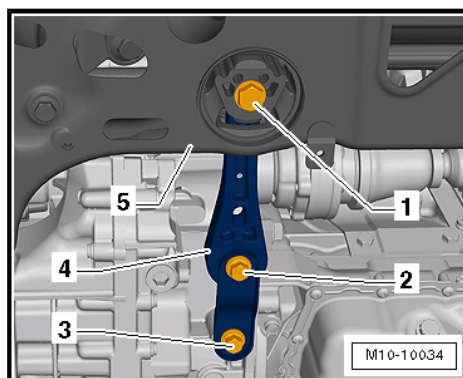
- ◆ ***Do not bend the decoupling element more than 10°.***
- ◆ ***Do not stretch the decoupling element.***
- ◆ ***Do not damage the wire mesh on the decoupling element.***



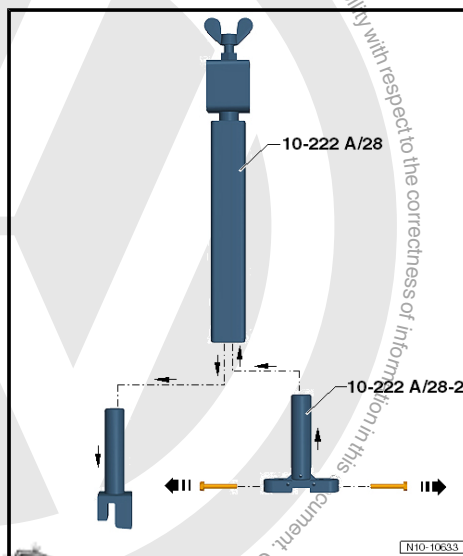
- Remove the exhaust system bracket from the subframe -arrows-.



- Remove the bolt -1-.
- Remove the bolts -2 and 3-.
- Remove the pendulum support.
- Remove the plenum chamber cover. Refer to ➔ Body Exterior; Rep. Gr. 50 ; Bulkhead; Plenum Chamber Cover, Removing and Installing .
- Remove the air filter housing. Refer to ➔ [“3.1 Overview - Air Filter Housing”, page 127](#) .
- Remove the battery and the battery tray. Refer to ➔ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery, Removing and Installing .
- Remove the bolts -arrows- from the left and right sides of the lock carrier bracket.



- Remove the lower mounts on the - 10-222A/28- and replace with the -10-222A/28-2- .
- Remove the bolts -arrows- for securing the engine support bridge on the lock carrier from the -10-222A/28-2- .



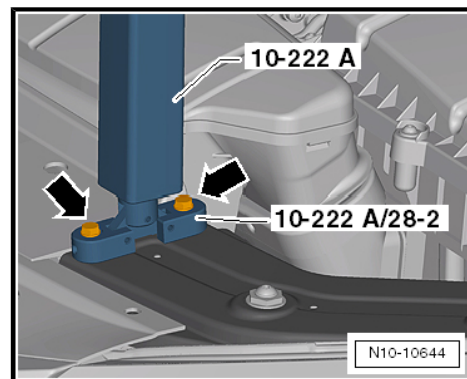


- Use the bolts from the -10-222A/28-2- for attaching the -10-222A/28-. Do not use the bolts for the bracket.
- Bolt tightening specification -arrows-: 8 Nm



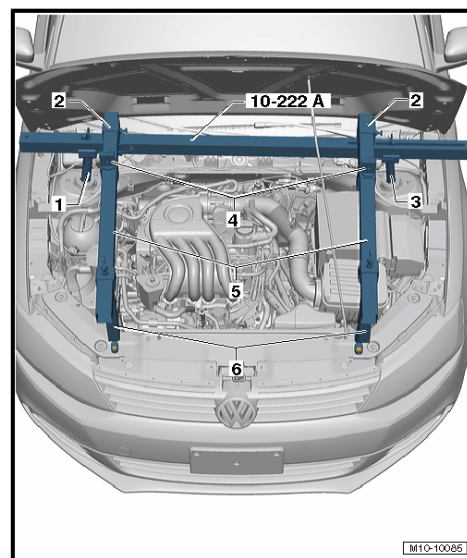
Caution

A second technician is needed when positioning the -10-222A- on the vehicle to keep the -10-222A- from tipping.



Mount the engine support bridge on the engine/transmission sub-assembly as follows:

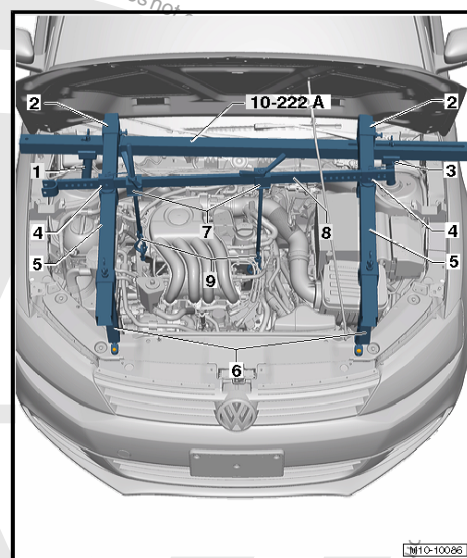
- 1 - -10-222A/31-2-
 - 2 - -T40091/3-
 - 3 - -10-222A/31-1-
 - 4 - -T40093/4-
 - 5 - -T40091/1-
 - 6 - -10-222A/28- with -10-222A/28-2-
- First slide the -T40091/3- - 2- onto the -T40091/1- on the -10-222A- .
 - The bolts for the -T40091/3- - 2- on the -10-222A- point in the direction of travel.
 - Mount the -10-222A- on the suspension strut domes and have a second technician hold it to prevent it from falling over.
 - Slide the -T40091/1- - 5- on the left and right sides through the -10-222A/28- - 6- from the front and position the Moveable Joints - T40093/4- - 4- on each side.



- Slide the -T40091/2- - 8- with the -T40093/5- - 7- into the -T40093/4- - 4-.

- 1 - -10-222A/31-2-
- 2 - -T40091/3-
- 3 - -10-222A/31-1-
- 4 - -T40093/4-
- 5 - -T40091/1-
- 6 - -10-222A/28- with -10-222A/28-2-
- 7 - -T40093/5-
- 8 - -T40091/2-
- 9 - - 10-222A/11-

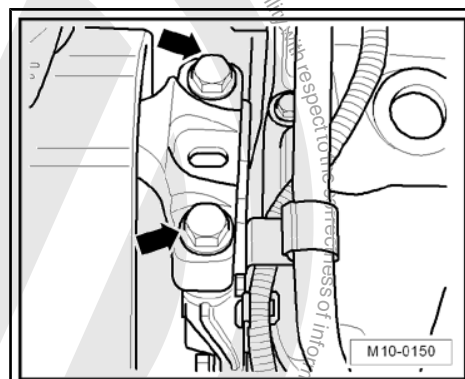
- Insert the securing pin into the -T40091/2- - 8- and secure it with cotter pins.
- Tighten all threaded connections on the -10-222A- hand-tight. While doing so, adjust the height of the -10-222A- parallel over the -10-222A/28- .
- Gently pretension the engine/transmission assembly via the -10-222A/11- - 9-, but do not lift.





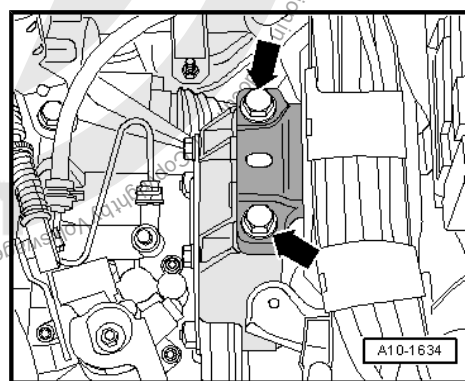
2.4 Subframe Mount, Adjusting

- Support the engine with the transmission but do not lift it. Refer to ➔ **“2.3 Engine, Supporting in Installed Position”, page 21** .
- Replace the subframe mount bolts -arrows- one after the other (if the was not already performed with the engine was installed) and hand tighten.



Vehicles with a Manual Transmission

- Replace the subframe mount bolts -arrows- one after the other (if the was not already performed with the engine was installed) and hand tighten.

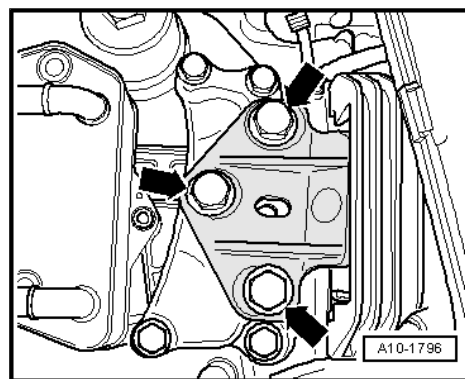


Vehicles with a S tronic Transmission

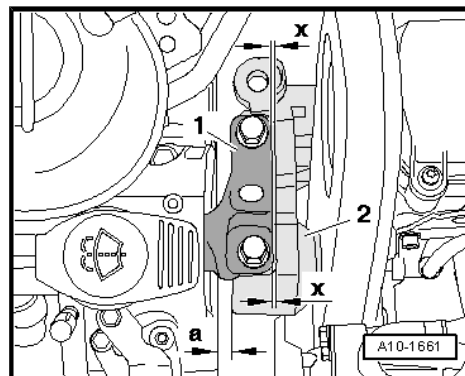
- Replace the subframe mount bolts -arrows- one after the other (if the was not already performed with the engine was installed) and hand tighten.

Continuation for All Vehicles

- Loosen left and right support arm bolts approximately 2 turns.



- Between engine support and right longitudinal member, there must be clearance -a- 10 mm.
- The casting edge on the engine support -2- must be parallel to the support arm -1-; dimension -x- must be the same at the front and at the rear.



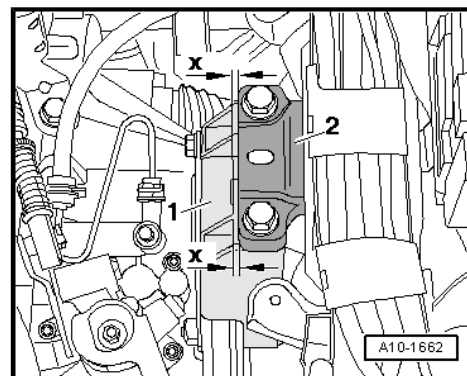


Vehicles with a Manual Transmission

- Make sure that the edges on the support arm -1- and transmission mount -2- are parallel on the transmission side.
- Dimension -x- same size on both sides of bracket.

Vehicles with a DSG Transmission

- Make sure that the edges on the support arm -1- and transmission mount -2- are parallel on the transmission side.



- Dimension -x- same size on both sides of bracket.

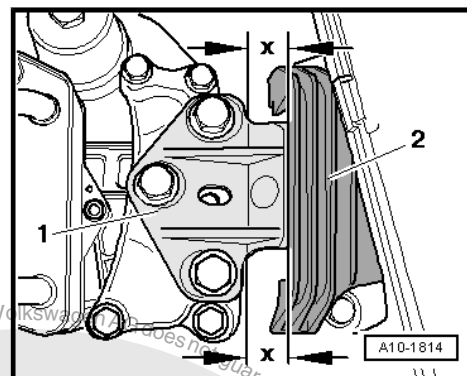
Continuation for All Vehicles

- Tighten subframe mount bolts.

Install in reverse order of removal.

Tightening specifications

- ◆ Refer to ⇒ [“2.1 Overview - Subframe Mount”, page 17](#)



2.5 Subframe Mount, Checking Adjustment

- There must be at least 10 to 13 mm -a- between engine support and right longitudinal member.
- The casting edge on the engine support -2- must be parallel to the support arm -1-; dimension -x- must be the same at the front and at the rear.

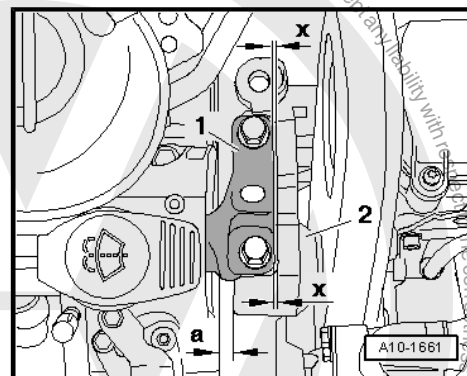


Note

Distance -a- can be checked with a corresponding round stock.

Only if there is noise (the engine or transmission hitting the longitudinal member when driving around curves) and dimension -a- is not within 10 to 13 mm:

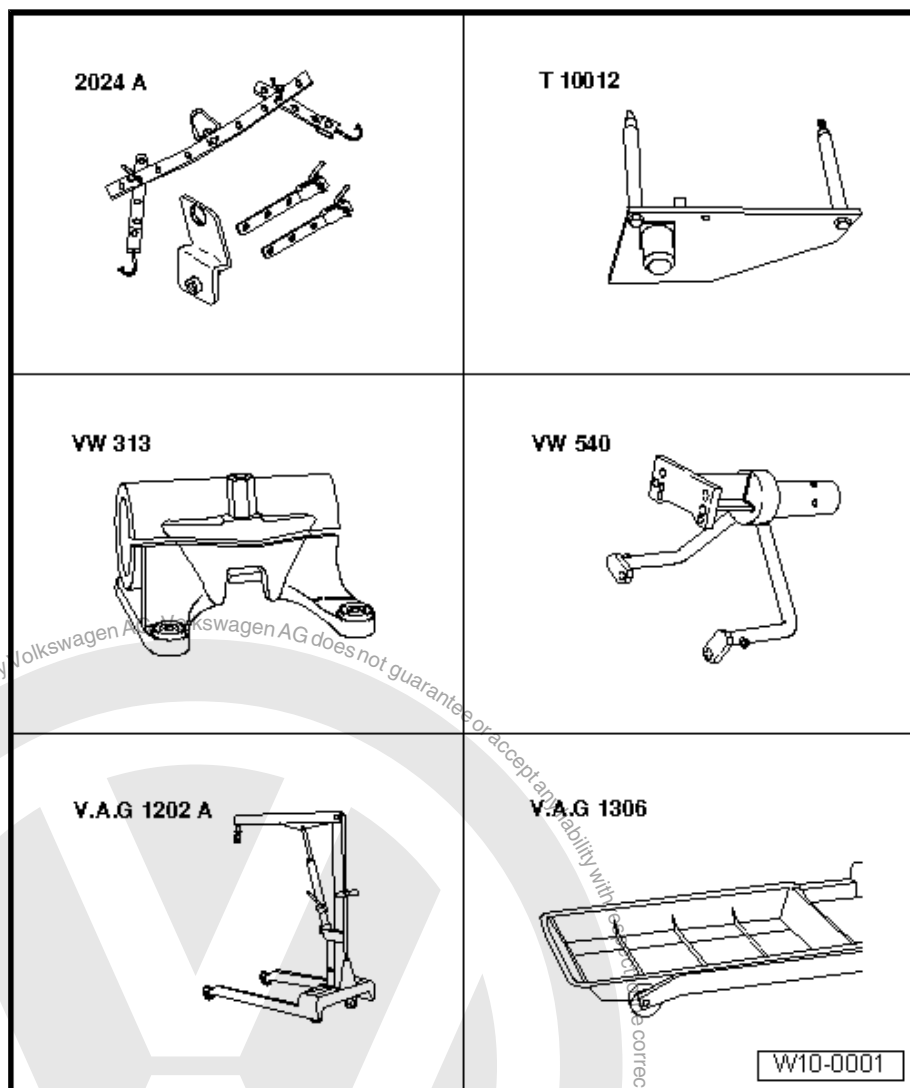
- Adjust the subframe mount. Refer to ⇒ [“2.4 Subframe Mount, Adjusting”, page 24](#).



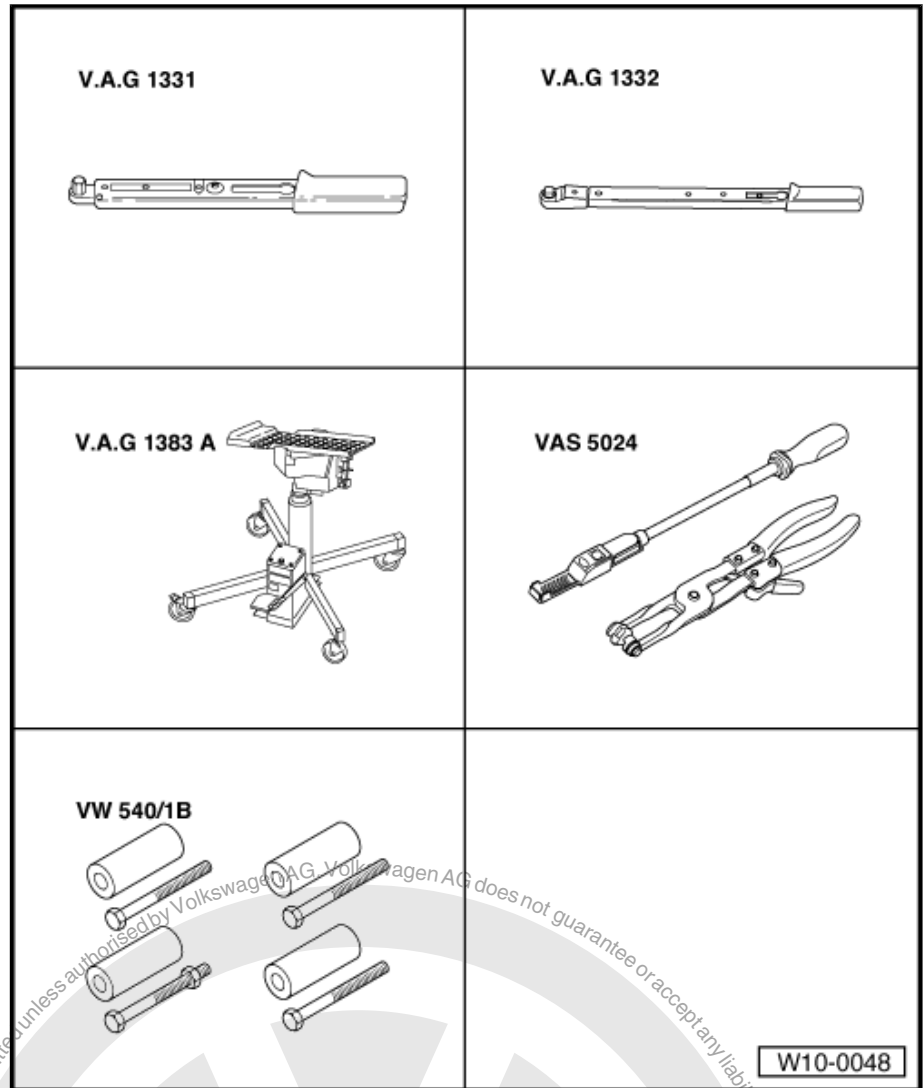


3 Special Tools

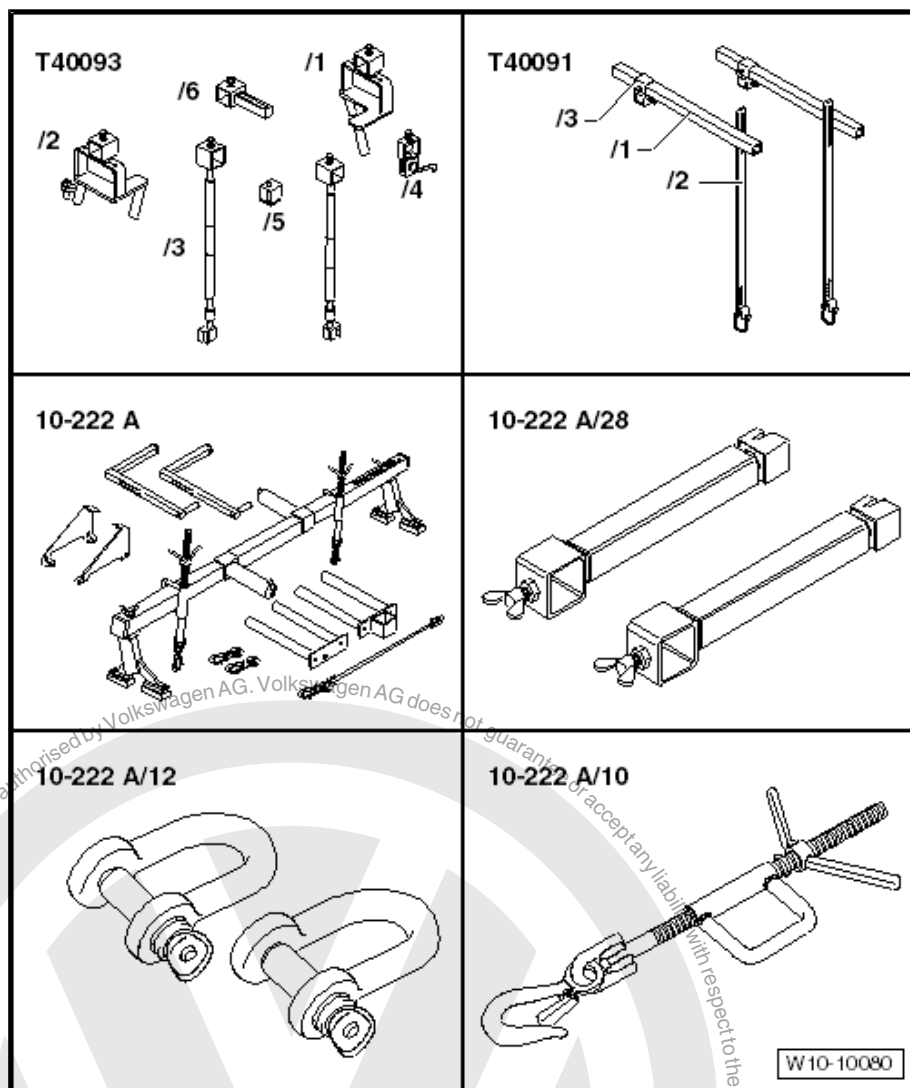
Special tools and workshop equipment required



- ◆ Engine Sling - 2024A-
- ◆ Engine/Trans. Support - T10012-
- ◆ Holding Fixture - VW313-
- ◆ Holding Fixture - VW540-
- ◆ Shop Crane - VAG1202A- or Shop Crane - VAS6100-
- ◆ Instrument/Gauge Tester - VAG1306- or Shop Crane - Drip Tray - VAS6208-



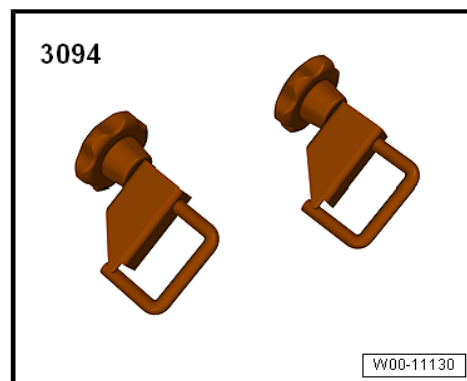
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Torque Wrench 1332 40-200Nm - VAG1332-
- ◆ Engine and Gearbox Jack - VAS6931-
- ◆ Hose Clip Pliers - VAS5024A-
- ◆ Holding Fixture - Spacers - VW540/1B-
- ◆ Lubricating Grease - G 000 100- (vehicles with manual transmission)



- ◆ Engine Support Bridge - 10-222A-
- ◆ Engine Support Bridge - Spindle - 10-222A/11-
- ◆ Engine Support Bridge - Engine Support 28 - 10-222A/28-
- ◆ Engine Support Bridge - Engine Support 31 - 10-222A/31-
- ◆ Rail with Holes - T40091/2- from the Engine Support - Basic Set - T40091-
- ◆ Mount - T40093/5- from the Engine Support - Supplement Kit - T40093A-
- ◆ Engine Support Bridge - Engine Support 28-2 - 10-222A/28-2- , quantity: 2
- ◆ Square Pipe - T40091/1- (quantity 2) from the Engine Support - Basic Set - T40091-
- ◆ Movable Joint - T40091/3- (quantity 2) from the Engine Support - Basic Set - T40091-
- ◆ Movable Joint - T40093/4- (quantity 2) from the Engine Support - Supplement Kit - T40091-



- ◆ Hose Clamps - Up To 25 mm - 3094-



- ◆ Commercially available step ladder





13 – Crankshaft, Cylinder Block

1 Cylinder Block, Belt Pulley Side

⇒ [“1.1 Overview - Cylinder Block, Belt Pulley Side”, page 30](#)

⇒ [“1.2 Ribbed Belt, Removing and Installing”, page 31](#)

⇒ [“1.3 Crankshaft Seal, Replacing, Belt Pulley Side”, page 33](#)

⇒ [“1.4 Sealing Flange, Removing and Installing, Belt Pulley Side”, page 34](#)

1.1 Overview - Cylinder Block, Belt Pulley Side

1 - Bolt

- ☐ 45 Nm

2 - Engine Support

3 - Bolt

- ☐ Container bracket for power steering fluid; Tightening specification - 23 Nm
- ☐ Belt pulley on pump; Tightening specification - 25 Nm

4 - Mount

- ☐ For the power steering fluid reservoir

5 - Toothed Belt Guard Upper Section

6 - Toothed Belt Guard Center Part

7 - Nut/bolt

- ☐ Nut tightening specification: 20 Nm
- ☐ Bolt tightening specification - item 15-
⇒ [Item 15 \(page 52\)](#)

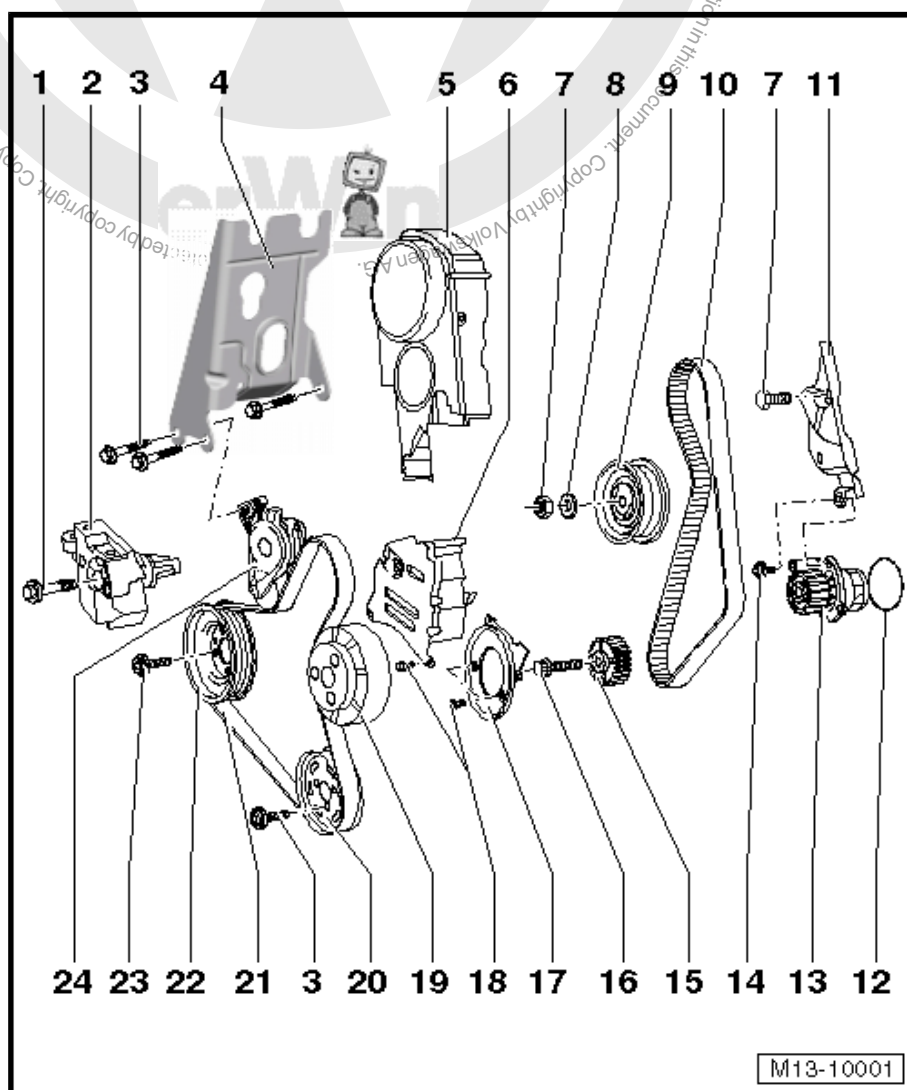
8 - Washer

9 - Tensioning Roller

- ☐ Checking the half automatic toothed belt tensioning roller. Refer to
⇒ [“2.3 Toothed Belt Drive Tensioner, Checking”, page 63](#).

10 - Toothed Belt

- ☐ Mark direction of travel before removing
- ☐ Check for wear
- ☐ Do not kink
- ☐ Removing and installing. Refer to ⇒ [“2.2 Toothed Belt, Removing and Installing”, page 59](#).





11 - Rear Toothed Belt Guard

12 - O-ring

- ☐ Replace after removing

13 - Coolant Pump

- ☐ Check for ease of movement
- ☐ Replace completely if damaged or leaking
- ☐ Removing and installing. Refer to ⇒ ["2.2 Coolant Pump, Removing and Installing", page 108](#) .

14 - Bolt

- ☐ Tightening specification. Refer to -item 14- ⇒ [Item 14 \(page 52\)](#) .

15 - Crankshaft Toothed Belt Sprocket

16 - Bolt

- ☐ Replace after removing
- ☐ Tightening specification. Refer to -item 16- ⇒ [Item 16 \(page 59\)](#) .

17 - Toothed Belt Guard Lower Section

18 - Bolt

- ☐ Replace after removing
- ☐ Tightening specification. Refer to -item 18- ⇒ [Item 18 \(page 59\)](#) .

19 - Belt Pulley

- ☐ For A/C compressor

20 - Belt Pulley

- ☐ For power steering pump

21 - Ribbed Belt

- ☐ Mark direction of travel before removing
- ☐ Check for wear
- ☐ Do not kink
- ☐ Removing and installing. Refer to ⇒ ["1.2 Ribbed Belt, Removing and Installing", page 31](#) .

22 - Belt Pulley/Vibration Damper

- ☐ It is possible to install in one position only, the holes are offset asymmetrically.
- ☐ Note position when installing toothed belt. Refer to
⇒ ["2.2 Toothed Belt, Removing and Installing", page 59](#) .

23 - Bolt

- ☐ 25 Nm

24 - Ribbed Belt Tensioner

- ☐ To release tension on ribbed belt, pivot using a wrench. Refer to
⇒ ["1.2 Ribbed Belt, Removing and Installing", page 31](#) .

1.2 Ribbed Belt, Removing and Installing

Special tools and workshop equipment required

- ◆ Locking Pin - T10060A-

Removing

- Remove the noise insulation. Refer to ⇒ Body Exterior; Rep.
Gr. 66 ; Noise Insulation; Overview - Noise Insulation .

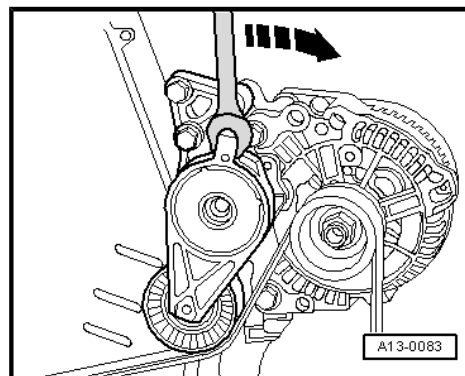


Caution

Risk of destroying due to reversed running direction on a used ribbed belt.

- ◆ ***If the ribbed belt is going to be installed again, mark the running direction with chalk or a marker.***

- Tilt the tensioner in the direction of -arrow- to release the tension on the ribbed belt.



- Secure the tensioner with -T10060A- .
- Remove the ribbed belt.

Installing

Install in reverse order of removal. Pay attention to the following:



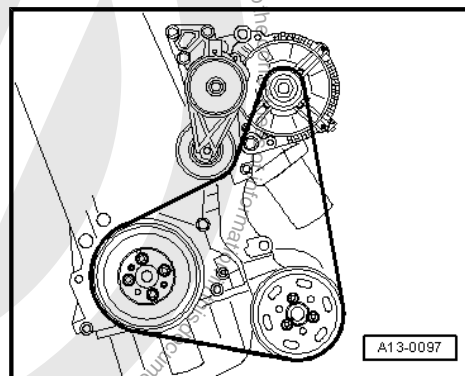
Note

- ◆ ***Make sure all assemblies (generator, A/C compressor and power steering pump) are installed securely before installing the ribbed belt.***
- ◆ ***Make sure the running direction of the ribbed belt is correct and that the belt is routed correctly over the belt pulley.***
- ◆ ***Route the ribbed belt last over the generator on vehicles without an A/C system.***
- ◆ ***Route the ribbed belt last over the A/C compressor on vehicles without an A/C system.***

After the work is completed:

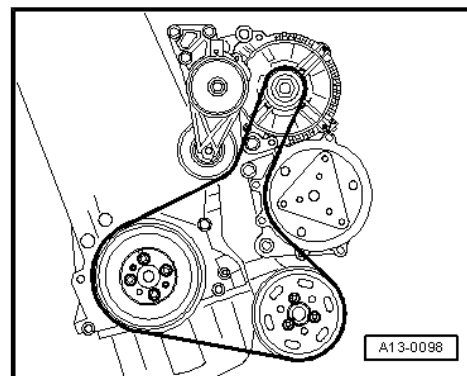
- Start the engine and check the belt running.

Belt Drive without A/C Compressor





Belt Drive with A/C Compressor



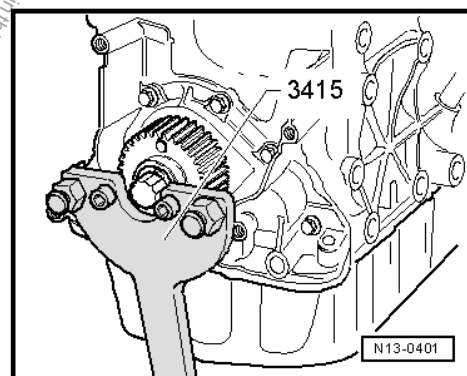
1.3 Crankshaft Seal, Replacing, Belt Pulley Side

Special tools and workshop equipment required

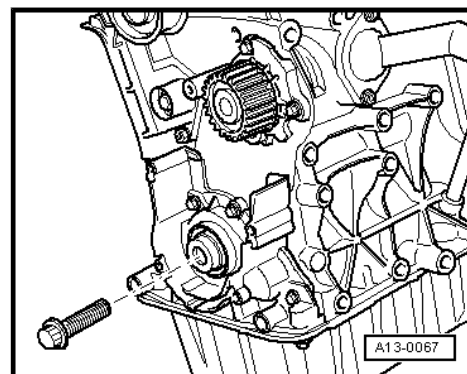
- ◆ Puller - Crankshaft Seal - 3203-
- ◆ Counterhold - Crankshaft Sprocket - 3415-
- ◆ Seal Installer - Crankshaft Seal - T10053-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Torque Wrench 1332 40-200Nm - VAG1332-

Removing

- Remove the ribbed belt. Refer to
 ⇒ ["1.2 Ribbed Belt, Removing and Installing", page 31](#) .
- Remove the toothed belt. Refer to
 ⇒ ["2.2 Toothed Belt, Removing and Installing", page 59](#) .
- Remove the crankshaft toothed belt sprocket. To do so, lock the toothed belt sprocket using the -3415- .



- Install the toothed belt crankshaft sprocket bolt by hand all the way into the crankshaft for guiding the seal remover.
- Remove the inner portion of -3203- nine rotations (approximately 20 mm) from outer panel and secure with knurled bolt.
- Lubricate the threaded head on the -3203- , position it and install it as far as possible into the seal using force.





- Loosen knurled thumb screw and turn inner portion against crankshaft until the seal is pulled out.

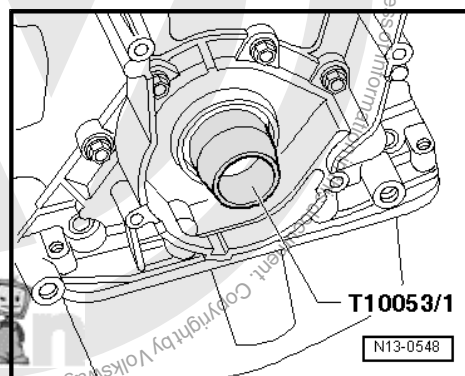
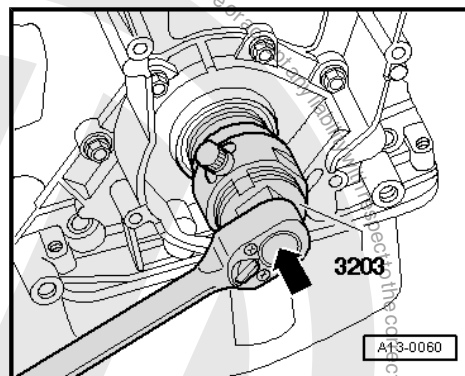
Installing



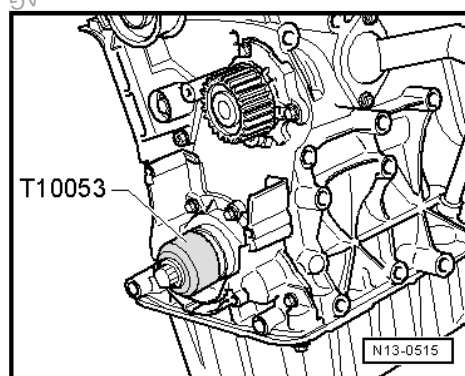
Note

Do not oil the sealing lip and outer edge of seal before installing it.

- Remove any oil residue on the crankshaft pins with a clean cloth.
- Attach the -T10053/1- guide sleeve on crankshaft pin.
- Slide seal over guide sleeve onto the crankshaft pin.



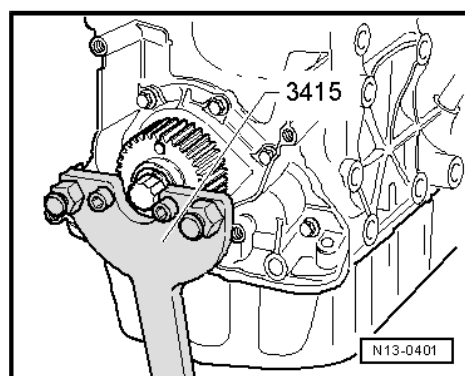
- Press in seal using the thrust sleeve from the -T10053- and the -T10053/2- (M16 x 1.5 x 60) until it stops.



- Install the crankshaft toothed belt sprocket. To do so, lock the toothed belt sprocket using the -3415- .
- Install a new central bolt.
- The central screw threads and shoulder must be free of oil and grease.

Additional turn can occur in several stages.

- Install the toothed belt. Refer to [⇒ "2.2 Toothed Belt, Removing and Installing", page 59](#) .
- Install the ribbed belt. Refer to [⇒ "1.2 Ribbed Belt, Removing and Installing", page 31](#) .



Tightening Specifications

- ♦ Refer to [⇒ "2.1 Overview - Toothed Belt", page 58](#)

1.4 Sealing Flange, Removing and Installing, Belt Pulley Side

Special tools and workshop equipment required

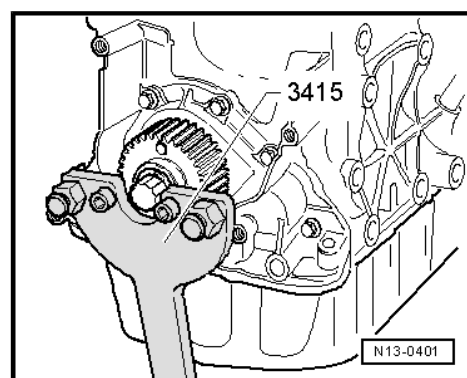
- ♦ Counterhold - Crankshaft Sprocket - 3415-



- ◆ Seal Installer - Crankshaft Seal - T10053-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Torque Wrench 1332 40-200Nm - VAG1332-
- ◆ For the correct sealant. Refer to the Parts Catalog.
- ◆ Hand drill with plastic brush attachment
- ◆ Flat scraper

Removing

- Remove the ribbed belt. Refer to
⇒ ["1.2 Ribbed Belt, Removing and Installing", page 31](#) .
- Remove the ribbed belt tensioning damper.
- Remove the toothed belt. Refer to
⇒ ["2.2 Toothed Belt, Removing and Installing", page 59](#) .
- Remove the crankshaft toothed belt sprocket. To do so, lock the toothed belt sprocket using the -3415- .
- Remove the oil pan. Refer to
⇒ ["1.3 Oil Pan, Removing and Installing", page 88](#) .
- Remove the sealing flange - belt pulley side.
- Remove the sealing flange. If necessary use a rubber hammer and tap it gently.
- Remove the seal from the sealing flange.
- Remove any sealant residue on the cylinder block using a flat blade scraper.

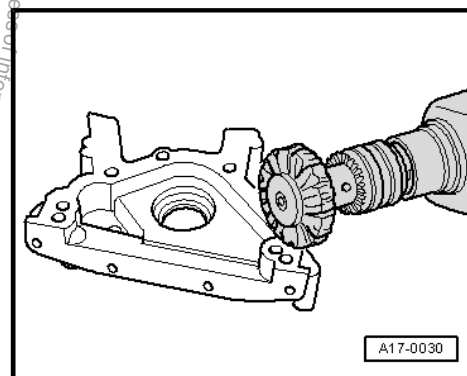


WARNING

To prevent injuries, wear protective eyewear and protective clothing.

- Remove the sealant residue on the sealing flange using a rotating brush such as a hand drill with a plastic brush attachment.
- Clean the sealing surfaces.
- Sealing surfaces must be completely free of oil and grease.

Installing





- Cut the nozzle on the tube at the front marking.
Nozzle diameter: approximately 3 mm
- Apply Sealant to the cleaned sealing surface on the sealing flange, as illustrated.
- Sealant bead thickness -arrows-: 2 to 3 mm



Note

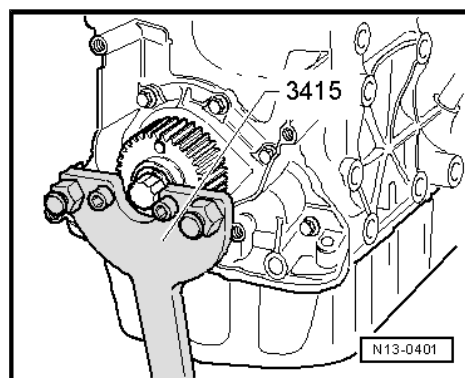
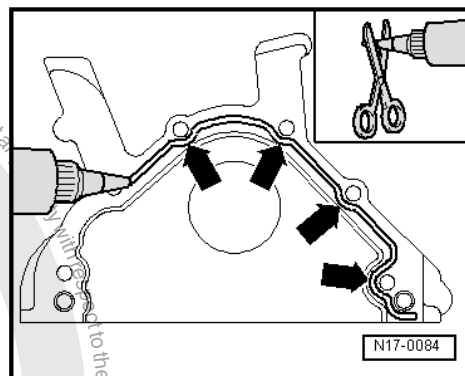
- ♦ *The sealant bead must not be thicker. The extra sealant will get into the oil pan and can clog up the intake line for the oil pump.*
- ♦ *Be sure to check the expiration date of the sealant.*
- ♦ *The sealing flange must be installed within 5 minutes of when the Sealant is applied.*
- ♦ *To position the sealing flange with the seal installed, place the -T10053/1- on the crankshaft journal.*
- Push the sealing flange carefully onto the alignment sleeves on the cylinder block and tighten the bolts hand-tight.
- Tighten the bolts on the sealing flange alternating in a diagonal sequence.

Component	Tightening Specifications
Sealing flange bolts	15 Nm

- Remove excess sealant.
- Install the oil pan. Refer to
⇒ ["1.3 Oil Pan, Removing and Installing", page 88](#) .
- Install the new crankshaft seal on the belt pulley side. Refer to
⇒ ["1.3 Crankshaft Seal, Replacing, Belt Pulley Side", page 33](#) .
- Install the crankshaft toothed belt sprocket. To do so, lock the toothed belt sprocket using the -3415- .
- Install a new central bolt.
- The central screw threads and shoulder must be free of oil and grease.
Additional turn can occur in several stages.
- Install the toothed belt. Refer to
⇒ ["2.2 Toothed Belt, Removing and Installing", page 59](#) .
- Install the ribbed belt. Refer to
⇒ ["1.2 Ribbed Belt, Removing and Installing", page 31](#) .

Tightening Specifications

- ♦ Refer to ⇒ ["2.1 Overview - Toothed Belt", page 58](#)





2 Cylinder Block, Transmission Side

⇒ [“2.1 Overview - Cylinder Block, Transmission Side”, page 37](#)

⇒ [“2.2 Drive Plate, Removing and Installing”, page 38](#)

2.1 Overview - Cylinder Block, Transmission Side



Note

Clutch, Servicing. Refer to ⇒ [Rep. Gr. 30 ; Clutch](#) .

1 - Central Bolt

- ☐ 90 Nm +90°
- ☐ Replace after removing

2 - Crankshaft Toothed Belt Sprocket

3 - Bolt

- ☐ 15 Nm

4 - Seal

- ☐ Do not lubricate or grease the sealing lip on the seal
- ☐ Replacing. Refer to ⇒ [“1.3 Crankshaft Seal, Replacing, Belt Pulley Side”, page 33](#) .

5 - Sealing Flange on Belt Pulley Side

- ☐ To remove, remove the oil pan. Refer to ⇒ [“1.3 Oil Pan, Removing and Installing”, page 88](#) .
- ☐ Must be located on dowel sleeves
- ☐ Removing and installing. Refer to ⇒ [“1.4 Sealing Flange, Removing and Installing, Belt Pulley Side”, page 34](#) .

6 - Cylinder Block

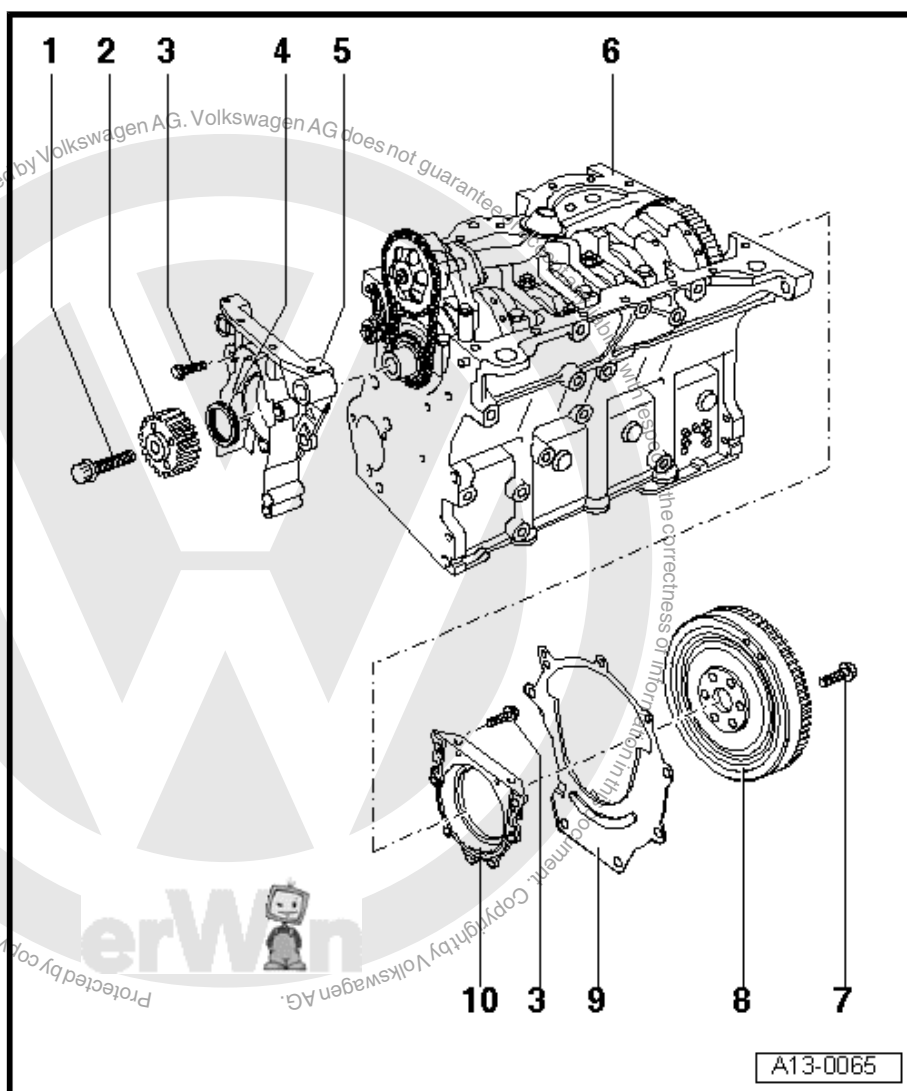
- ☐ Crankshaft. Refer to ⇒ [“3 Crankshaft”, page 40](#) .
- ☐ Piston and connecting rod. Refer to ⇒ [“4 Piston and Connecting Rod”, page 43](#) .

7 - Bolt

- ☐ 60 Nm +90°
- ☐ Replace after removing

8 - Flywheel/Drive Plate

- ☐ Drive plate, removing and installing. Refer to ⇒ [“2.2 Drive Plate, Removing and Installing”, page 38](#) .





9 - Intermediate Plate

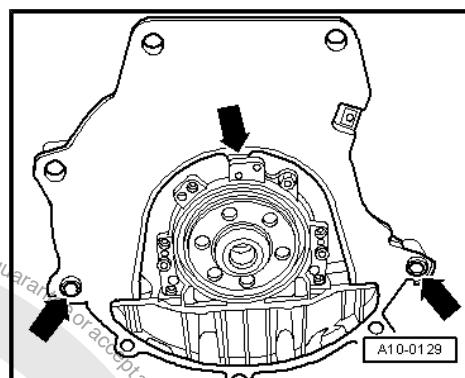
- ☐ Must be located on dowel sleeves. Refer to
⇒ [Fig. "Intermediate Plate Installation Position", page 38](#)
- ☐ Be careful not to damage or bend when installing

10 - Sealing Flange - Transmission Side With Seal

- ☐ Replace only as a complete unit.
- ☐ Use the support sleeve provided with it when installing
- ☐ To remove, remove the oil pan. Refer to ⇒ ["1.3 Oil Pan, Removing and Installing", page 88](#).
- ☐ Before installing, remove oil remains from crankshaft journal with a clean cloth
- ☐ Do not lubricate or grease the sealing lip on the seal
- ☐ Supporting sleeve may only be removed after the sealing flange has been slid onto the crankshaft pin.

Intermediate Plate Installation Position

- Engage the intermediate plate with the sealing flange and then slide it onto the alignment sleeves -arrows-.



2.2 Drive Plate, Removing and Installing

Special tools and workshop equipment required

- ◆ Flywheel Lock Adapter - VW558-
- ◆ M 8 x 45 hex bolt and two M 10 hex nuts
- ◆ Depth Gauge

Removing

- Secure the -VW558- to the drive plate with the M8 x 45 hex bolt. To do this, insert two M10 hex nuts between flywheel lock adapter and drive plate.

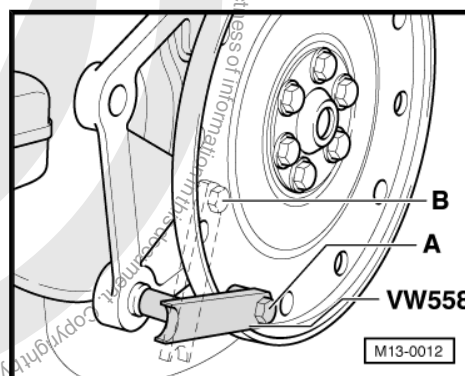
Installed location of flywheel retainer:

A - To loosen

B - To tighten

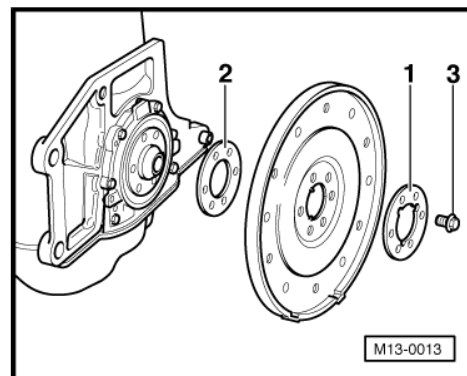
- Remove the bolts from the drive plate.

Installing





- Set drive plate in place, using washer with notches -1-.
- Install the new bolts -3- and tighten to 30 Nm.



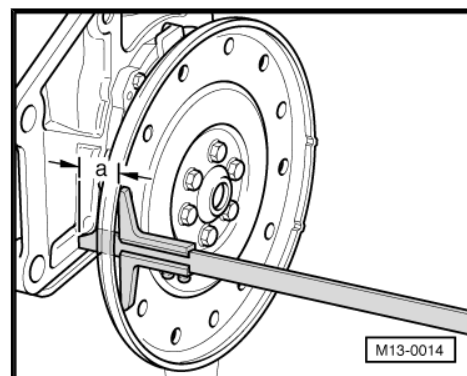
- Measure the dimension -a- at 3 different outer holes in the drive plate (offset 120°), and then calculate the average.
- Specified value for dimension a: 19.5 to 21.1 mm



Note

This is measured through the hole in the drive plate to the machined surface of the cylinder block. Disengage the intermediate plate. Refer to

⇒ Fig. “Intermediate Plate Installation Position”, page 38.

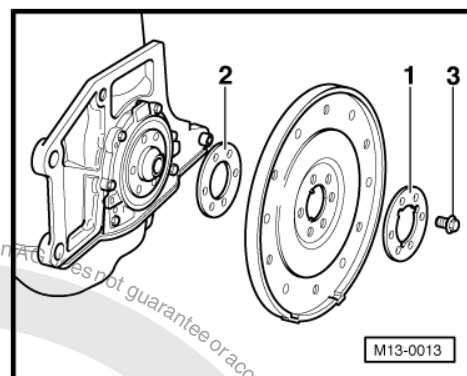


If the specification is not obtained:

- Remove the drive plate one more time and use the shim -2-.
 - Tighten bolts -3- again to 30 Nm.
 - Tighten the bolts on the drive plate.
- Additional turn can occur in several stages.

Tightening Specifications

- ◆ Refer to
 ⇒ [“2.1 Overview - Cylinder Block, Transmission Side”, page 37](#)





3 Crankshaft

⇒ "3.1 Overview - Crankshaft", page 40

⇒ "3.2 Crankshaft Dimensions", page 42

3.1 Overview - Crankshaft



Note

- ♦ Before removing crankshaft, prepare for appropriate storage, so that sensor wheel -item 8- ⇒ [Item 8 \(page 41\)](#) does not make contact or become damaged.
- ♦ Secure the engine to the assembly stand using the Holding Fixture - VW540- when performing assembly work. To do so, also use the Holding Fixture - Spacers - VW540/1B- .

1 - Oil Pump

- ☐ With pressure relief valve 12 bar (174 psi)
- ☐ Before installing, check to be sure both alignment bushings are present (for centering oil pump/cylinder block)
- ☐ Removing and installing. Refer to ⇒ ["1.4 Oil Pump, Removing and Installing", page 91](#) .

2 - Bolt

- ☐ 15 Nm

3 - Chain Sprocket

- ☐ For oil pump drive

4 - Bearing Shells

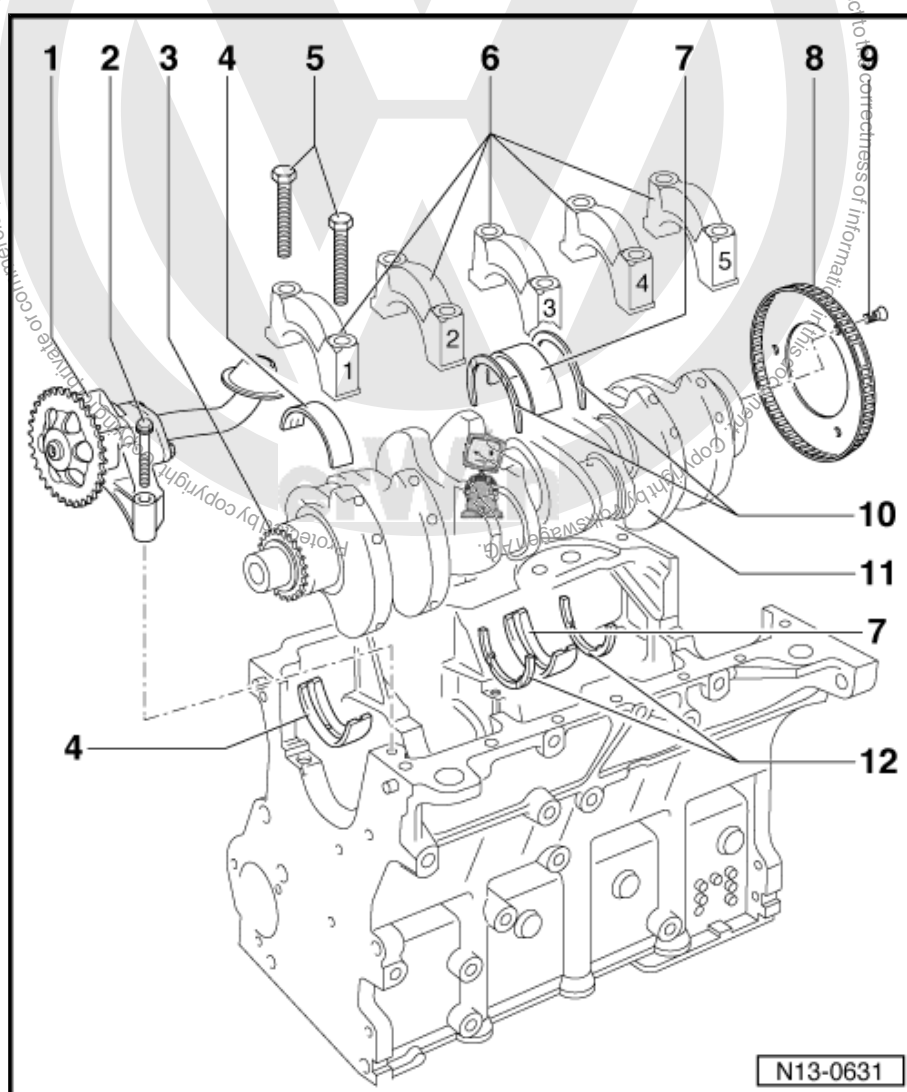
- ☐ Classification for replacement part ordering. Refer to ⇒ [Fig. "Upper Crankshaft Bearing Identification", page 42](#)
- ☐ For bearing cap without oil groove
- ☐ For cylinder block with oil groove
- ☐ Do not interchange used bearing shells (mark)

5 - Bolt

- ☐ 65 Nm +90°
- ☐ Replace after removing
- ☐ Fully threaded
- ☐ Only tighten crankshaft to 65 Nm to measure radial play.

6 - Bearing Cap

- ☐ Bearing cap 1: belt pulley side
- ☐ Bearing cap 3: with openings for thrust washers
- ☐ Retaining tabs of bearing shells and cylinder block/bearing caps must lie above one another





7 - Bearing Shell 3

- ☐ Classification for replacement part ordering. Refer to
⇒ [Fig. "Upper Crankshaft Bearing Identification", page 42](#)
- ☐ For bearing cap without oil groove
- ☐ For cylinder block with oil groove
- ☐ Do not interchange used bearing shells (mark)

8 - Sensor Wheel

- ☐ Replace after removing
- ☐ For Engine Speed Sensor - G28-
- ☐ It is possible to install in one position only, the holes are offset asymmetrically.

9 - Bolt

- ☐ 10 Nm +90°
- ☐ Replace after removing

10 - Thrust Washer

- ☐ For bearing cap, bearing 3
- ☐ Pay attention to the locating point
- ☐ The letters face the bracket

11 - Crankshaft

- ☐ Axial play
New: 0.07 to 0.23 mm
wear limit: 0.30 mm
- ☐ Measure the radial clearance with a Plastigauge®.
New: 0.01 to 0.04 mm
Wear limit: 0.15 mm
- ☐ Do not turn crankshaft when measuring radial play
- ☐ Crankshaft dimensions. Refer to ⇒ ["3.2 Crankshaft Dimensions", page 42](#).

12 - Thrust Washer

- ☐ For cylinder block, bearing 3
- ☐ The letters face the bracket



Upper Crankshaft Bearing Identification

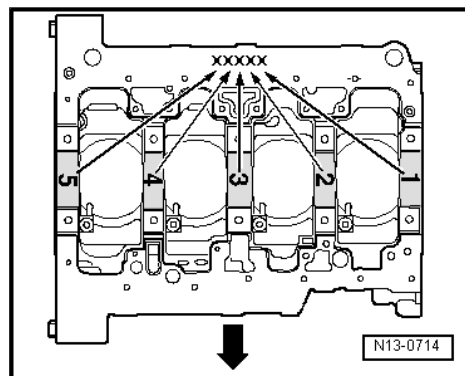
From the factory, the upper bearing shells are allocated to the cylinder block with the correct thickness. The color dots identify the bearing shell thickness. Refer to ➤ [page 42](#) .

The letters -x- marked on the lower sealing surface of the cylinder block identify which bearing thickness must be installed in which location.

The arrow points in the direction of travel.

Bearing Shell Color Identification

Letter On Cylinder Block	Bear Shell Color
S	Black
R	Red
G	Yellow



Note

- ◆ If the color markings are not yet stamped on or no longer readable, use the center (red) bearing shell.
- ◆ The lower crankshaft bearing shells are shipped as a replacement part and have a "yellow" dot.

3.2 Crankshaft Dimensions

(Dimensions in mm)

Honing Dimension	Crankshaft Bearing	Connecting Rod Bearing
	Stub Axle Diameter	Stub Axle Diameter
Standard dimension	-0.017	-0.022
	54.00	47.80
1st oversize	-0.037	-0.042
	-0.017	-0.022
2nd oversize	53.75	47.55
	-0.037	-0.042
Stage III	-0.017	-0.022
	53.50	47.30
	-0.037	-0.042
	-0.017	-0.022
	53.25	47.05
	-0.037	-0.042



4 Piston and Connecting Rod

⇒ [“4.1 Overview - Piston and Connecting Rod”, page 43](#)

⇒ [“4.2 New Connecting Rod, Separating”, page 44](#)

⇒ [“4.3 Pistons and Cylinder Bore, Checking”, page 45](#)

4.1 Overview - Piston and Connecting Rod

1 - Connecting Rod Bolt

- ☐ 30 Nm +90°
- ☐ Tighten to 30 Nm to measure radial play but do not tighten further.
- ☐ Replace after removing
- ☐ Lubricate the thread and contact surface.

2 - Relief Valve

- ☐ 27 Nm
- ☐ Opening pressure: 1.3 to 1.6 bar (18.85 to 23.2 psi) pressure

3 - Oil Spray Jet

- ☐ For piston cooling

4 - Connecting Rod Bearing Cap

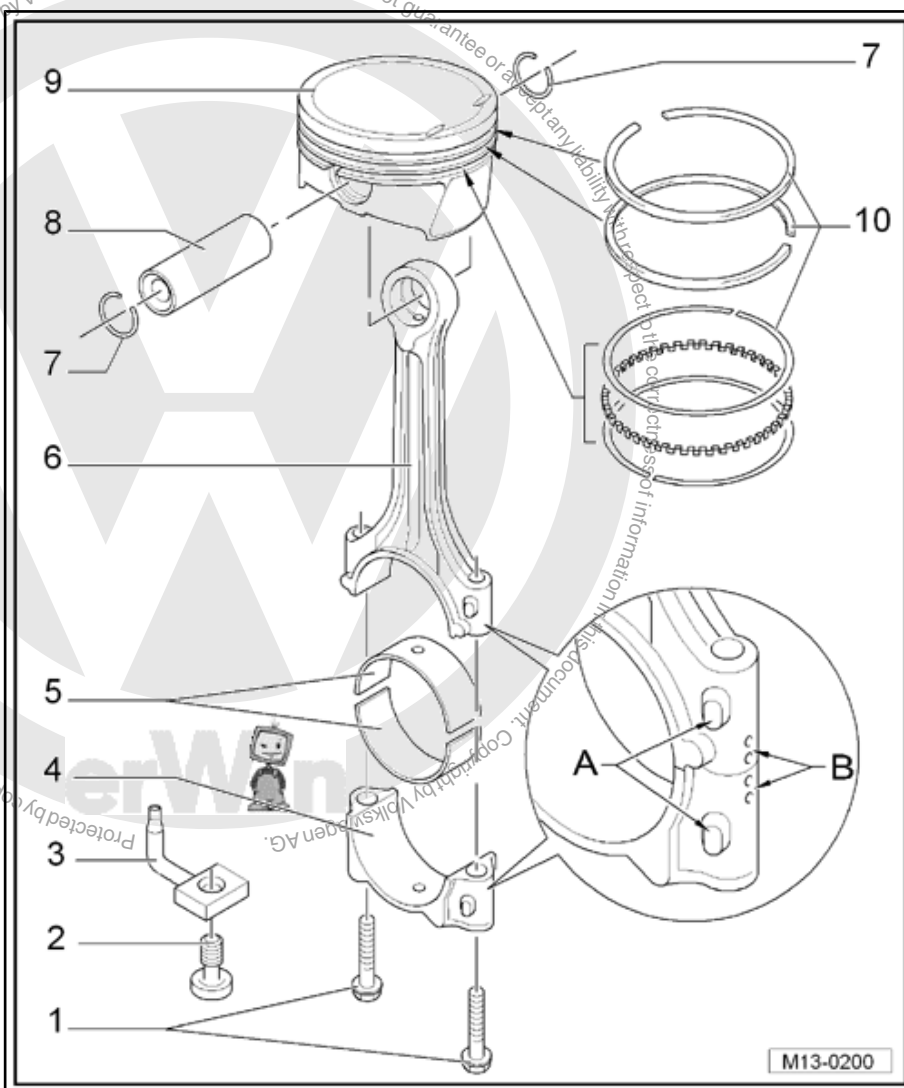
- ☐ Note the installation position
- ☐ Due to the separation procedure (cracking) of the connecting rod, the cap only fits in one position and only to the corresponding connecting rod.
- ☐ Mark which cylinder to which it belongs -B-.
- ☐ Installed position: markings -A- face the pulley side

5 - Bearing Shell

- ☐ Note the installation position. Refer to
 ⇒ [Fig. “Bearing Shells Installed Position””, page 44](#) .
- ☐ Do not interchange used bearing shells.
- ☐ Axial play
 New: 0.10 to 0.35 mm
 wear limit: 0.4 mm
- ☐ Measure radial clearance with Plastigauge®:
 New: 0.01 to 0.06 mm
 wear limit: 0.09 mm
 Do not turn crankshaft when checking radial clearance

6 - Connecting Rod

- ☐ With cracked bearing cap
- ☐ Separate new connecting rod. Refer to ⇒ [“4.2 New Connecting Rod, Separating”, page 44](#)





- ☐ Always replace as a set.
- ☐ Mark which cylinder to which it belongs -B-.
- ☐ Installed position: markings -A- face the pulley side

7 - Circlip

8 - Piston Pin

- ☐ If difficult to move, heat piston to 60 °C (140 °F)
- ☐ Remove and install using the Pilot Drift - VW222A-

9 - Piston

- ☐ Checking. Refer to ➤ [Fig. "Pistons, Checking", page 46](#) .
- ☐ Mark installed position and cylinder allocation
- ☐ Arrow on piston face points toward belt pulley side
- ☐ Install with mounting strap piston ring
- ☐ Cylinder bore, checking. Refer to ➤ [Fig. "Cylinder Bore, Checking", page 46](#) .
- ☐ Piston and cylinder dimensions. Refer to ➤ [page 47](#) .

10 - Piston Rings

- ☐ Offset gaps by 120°
- ☐ Use piston ring pliers for removing and installing
- ☐ Markings face toward piston crown
- ☐ Checking the ring gap. Refer to ➤ [Fig. "Checking the Piston Ring Gap", page 45](#) .
- ☐ Checking the piston ring groove clearance. Refer to ➤ [Fig. "Piston Ring Groove Clearance, Checking", page 45](#) .

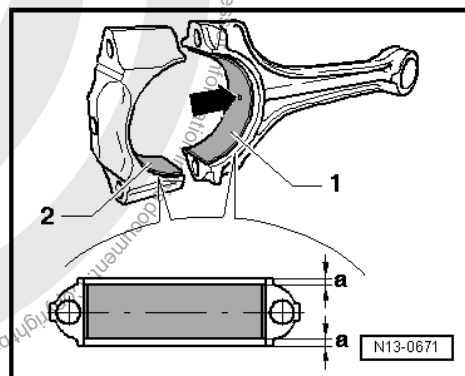
Bearing Shells Installed Position

Bearing shell -1- with connecting rod oil bore -arrow-.

Bearing shell -2- without oil bore for connecting rod cover.

- Place bearing shells centrally into connecting rod and connecting rod bearing cap.

Dimension -a- must be the same at left and right.



4.2 New Connecting Rod, Separating

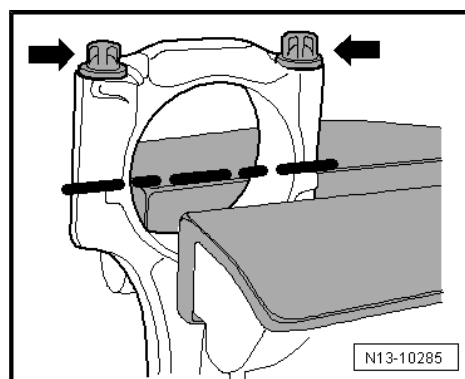
New connecting rods might not be separated at the location where they should be. If the connecting rod bearing cap cannot be removed by hand, proceed as follows:

- Mark the cylinder where the connecting rod belongs. Refer to -item 4- ➤ [Item 4 \(page 43\)](#) .
- Lightly clamp the connecting rod in a vise equipped with aluminum protective pads.

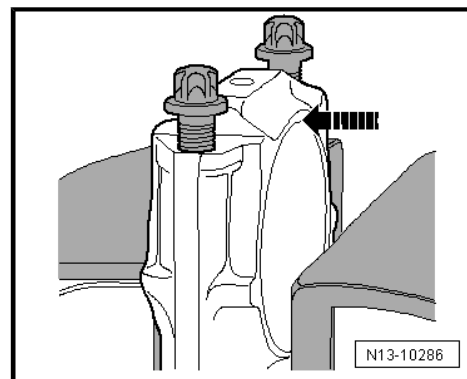


Note

- ◆ Clamp the connecting rod lightly to prevent damaging it.
- ◆ Clamp the connecting rod below the dotted line.
- Loosen the bolts -arrows- approximately 5 turns.

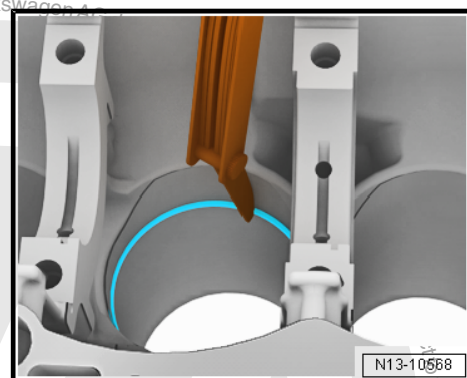


- Carefully tap against the connecting rod bearing cap in direction of -arrow- with a plastic hammer until the cap is loose.



4.3 Pistons and Cylinder Bore, Checking

Checking the Piston Ring Gap



Special tools and workshop equipment required

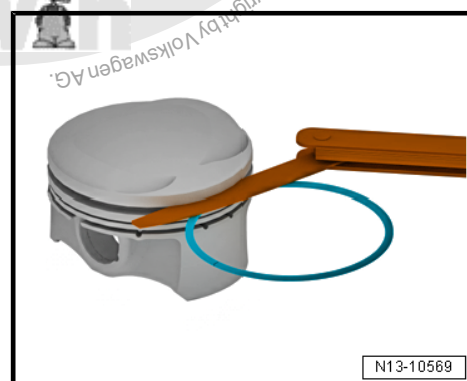
◆ Feeler Gauge

- Insert the piston ring into the lower cylinder opening at a right angle from above approximately 15 mm away from the cylinder edge.

To do this use a piston without piston rings.

Piston Ring		Gap	
		New	Wear limit
Compression rings	mm	0.20 to 0.40	0.8
Oil scraping ring	mm	0.25 to 0.50	0.8

Piston Ring Groove Clearance, Checking



Special tools and workshop equipment required

◆ Feeler Gauge

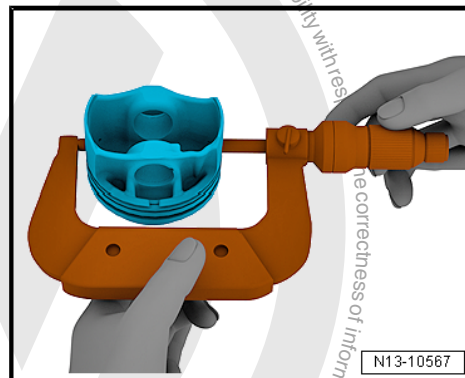
- Clean the ring groove before checking.

Piston Ring		Ring to Groove Clearance	
		New	Wear limit
Compression rings	mm	0.06 to 0.09	0.20



Piston Ring		Ring to Groove Clearance	
Oil scraping ring	mm	0.03 to 0.06	0.15

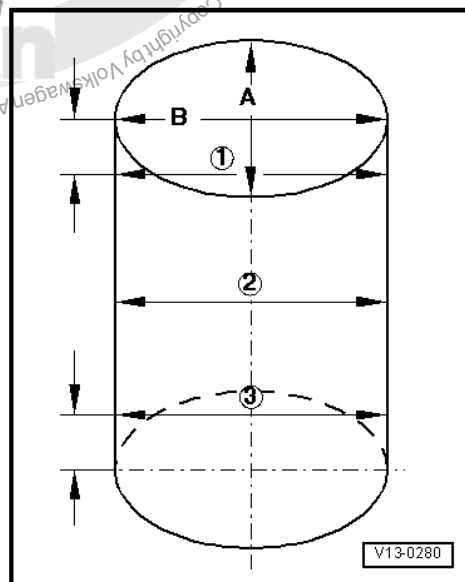
Pistons, Checking



Special tools and workshop equipment required

- ◆ External micrometer 75 to 100 mm
- Take measurement approximately 10 mm from lower edge of piston skirt and offset 90° to piston axis.
- Deviations from the specified size: maximum 0.04 mm

Cylinder Bore, Checking



Special tools and workshop equipment required

- ◆ Internal dial gauge 50 to 100 mm
- Measure diagonally at three positions transversely -A- and longitudinally -B-.
- Deviation from nominal dimension: maximum 0.08 mm



Note

- ◆ *Cylinder bore must not be measured if cylinder block is secured to assembly stand or else results may be incorrect.*
- ◆ *Incorrect measurements will result.*



Piston and Cylinder Dimensions

Honing Dimension		Piston Diameter	Cylinder Bore Diameter
Standard dimension	mm	82.465 ¹⁾	82.51

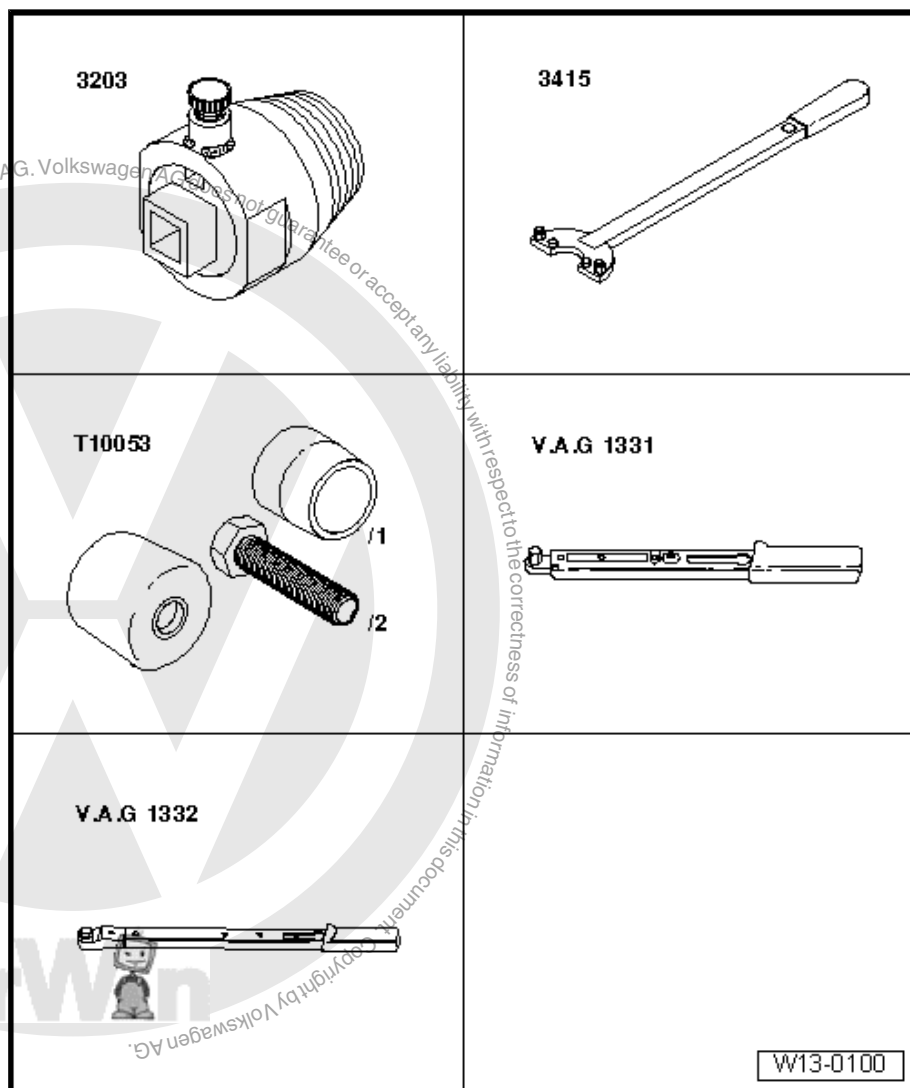
¹⁾ Measurements without graphite coating (thickness = 0.02 mm).
 The graphite coating wears off.



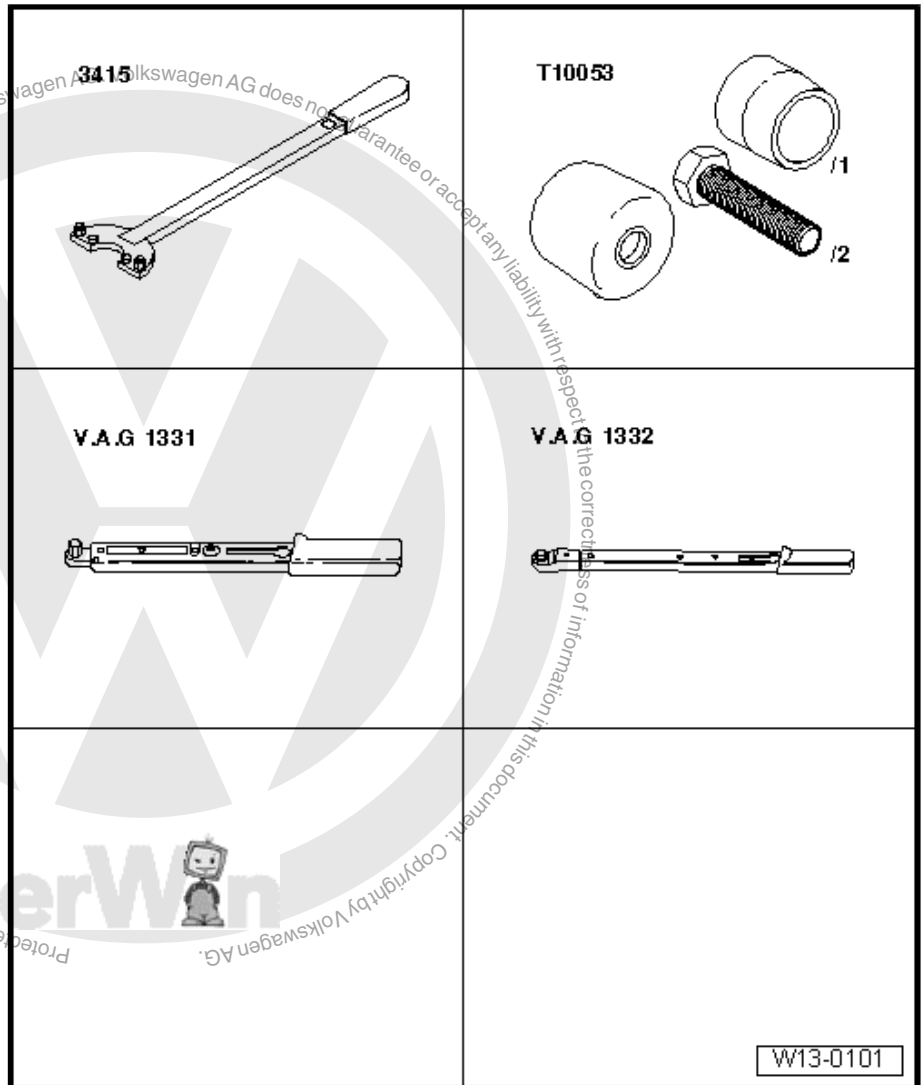


5 Special Tools

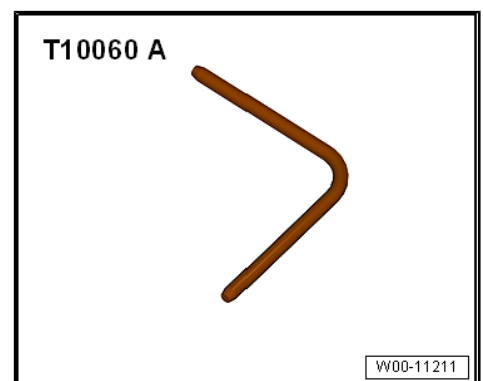
Special tools and workshop equipment required



- ◆ Puller - Crankshaft Seal - 3203-
- ◆ Counterhold - Crankshaft Sprocket - 3415-
- ◆ Seal Installer - Crankshaft Seal - T10053-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Torque Wrench 1332 40-200Nm - VAG1332-

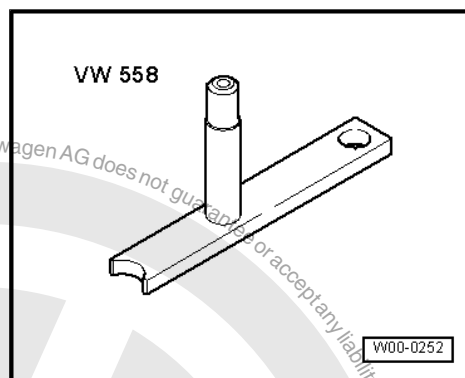


- ◆ Counterhold - Crankshaft Sprocket - 3415-
- ◆ Seal Installer - Crankshaft Seal - T10053-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Torque Wrench 1332 40-200Nm - VAG1332-
- ◆ Locking Pin - T10060A-





- ◆ Flywheel Lock Adapter - VW558-



- ◆ M 8 x 45 hex bolt and two M 10 hex nuts
- ◆ Depth Gauge



15 – Cylinder Head, Valvetrain

1 Cylinder Head

⇒ [“1.1 Overview - Cylinder Head”, page 51](#)

⇒ [“1.2 Cylinder Head, Removing and Installing”, page 53](#)

⇒ [“1.3 Compression Pressure, Checking”, page 56](#)

1.1 Overview - Cylinder Head



Note

- ◆ *When using an exchanged cylinder head with camshaft installed, the contact surfaces between the lifters and cam lobes must be lubricated before installing the cylinder head cover.*
- ◆ *The plastic protectors installed to protect the open valves must only be removed immediately before mounting the cylinder head.*
- ◆ *All of the coolant must be changed if the cylinder head was replaced.*
- ◆ *Intake manifold with fuel rail, removing and installing. Refer to [“4.3 Intake Manifold with Fuel Rail, Removing and Installing”, page 131](#).*



1 - Sealing Plugs

2 - To Intake Tube

- ☐ -Item 6-
⇒ [Item 6 \(page 127\)](#)

3 - Molded Hose

4 - To Intake Manifold

- ☐ -Item 16-
⇒ [Item 16 \(page 130\)](#)

5 - O-ring

- ☐ No replacement part

6 - Sealing Plug

- ☐ 15 Nm
- ☐ No replacement part

7 - Cylinder Head Bolt

- ☐ Replace after removing
- ☐ Cylinder head, removing and installing. Refer to
⇒ ["1.2 Cylinder Head, Removing and Installing", page 53](#).

8 - Connection

- ☐ Coolant hose connection diagram. Refer to
⇒ ["1.1 Connection Diagram - Coolant Hoses", page 99](#).

9 - Bolt

- ☐ 9 Nm

10 - O-ring

- ☐ Replace after removing

11 - Bolt

- ☐ 20 Nm

12 - Lifting Eye

13 - Cylinder Head Gasket

- ☐ Replace after removing
- ☐ After replacing, replace entire amount of coolant.

14 - Bolt

- ☐ 15 Nm

15 - Bolt

- ☐ 20 Nm

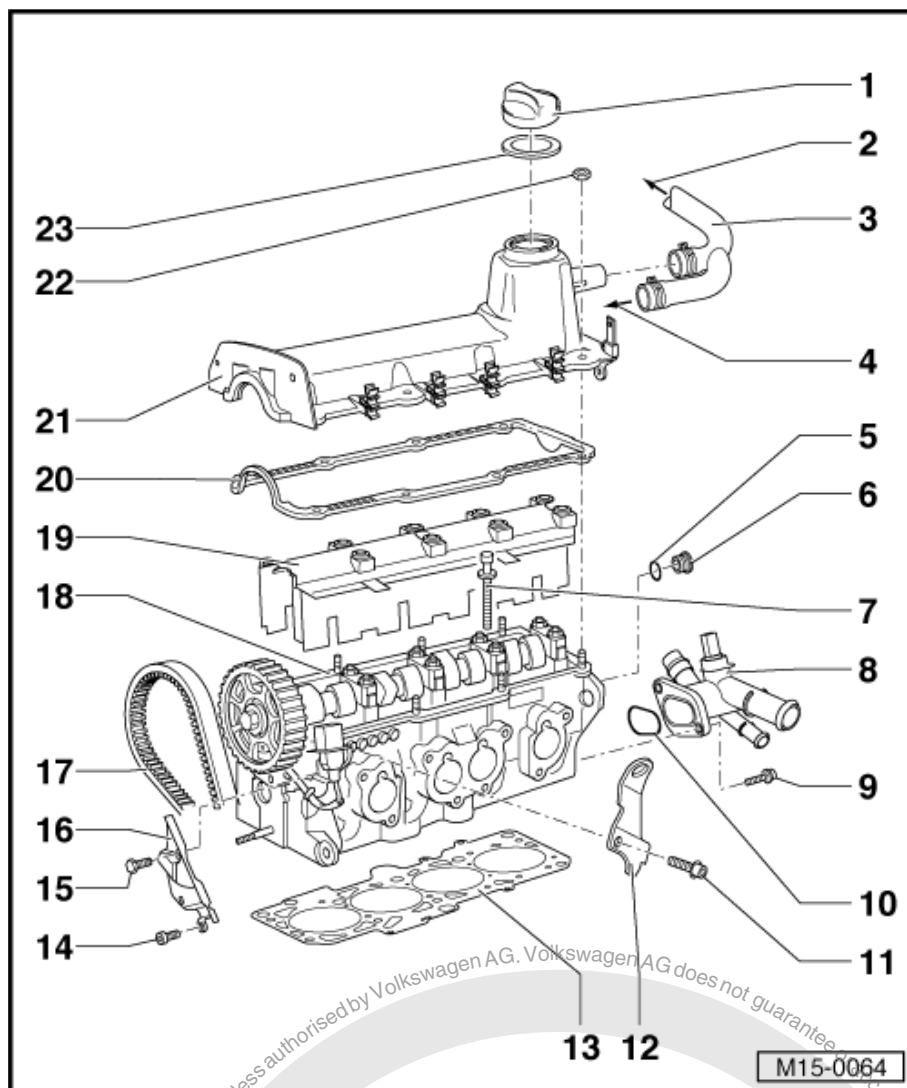
16 - Rear Toothed Belt Guard

17 - Toothed Belt

- ☐ Mark direction of travel before removing
- ☐ Check for wear
- ☐ Do not kink
- ☐ Removing and installing. Refer to ⇒ ["2.2 Toothed Belt, Removing and Installing", page 59](#).

18 - Cylinder Head

- ☐ Check for distortion. Refer to ⇒ [Fig. "Checking Cylinder Head for Distortion", page 53](#)



- ☐ Resurfacing sealing surfaces. Refer to
⇒ Fig. “Cylinder Head - Sealing Surface, Resurfacing”, page 67
- ☐ Removing and installing. Refer to ⇒ “1.2 Cylinder Head, Removing and Installing”, page 53.
- ☐ After replacing, replace entire amount of coolant.

19 - Oil Separator

20 - Cylinder Head Cover Gasket

- ☐ Replace if damaged
- ☐ Before installing, coat the bearing cover/cylinder head contact surfaces with Sealant

21 - Cylinder Head Cover

- ☐ With wiring guides

22 - Bolt

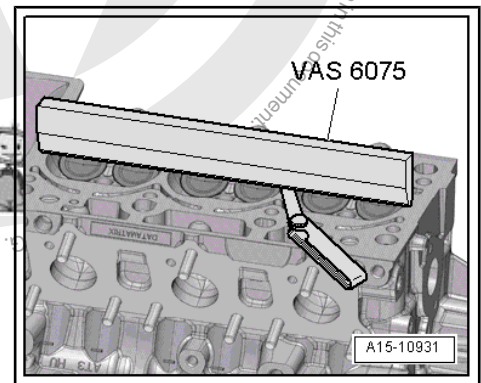
- ☐ 10 Nm

23 - Seal

Checking Cylinder Head for Distortion

Check using Straight Edge - 500mm - VAS6075- and feeler gauge

- Permissible distortion: 0.1 mm
- Minimum distance of the linear surface: 100 mm



1.2 Cylinder Head, Removing and Installing

Special tools and workshop equipment required

- ◆ Instrument/Gauge Tester - VAG1306- or Shop Crane - Drip Tray - VAS6208-
- ◆ Torque Wrench 1332 40-200Nm - VAG1332 -
- ◆ Hose Clip Pliers VAS5024A
- ◆ Head Gasket Alignment Tool - Pins - 3450/2A-
- ◆ Head Gasket Alignment Tool - Rod - 3450/3-
- ◆ Wrench - 3452- or Polydrive Bit Drive Socket - T10070-
- ◆ Toothed Belt Tensioner - T10020-
- ◆ Puller - Spark Plug Connector - T10112A-



Note

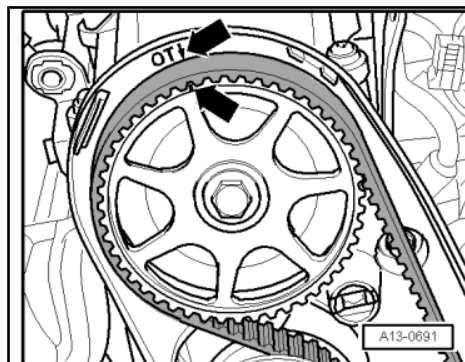
- ◆ *When using an exchanged cylinder head with camshaft installed, the contact surfaces between the lifters and cam lobes must be lubricated before installing the cylinder head cover.*
- ◆ *The plastic protectors installed to protect the open valves must only be removed immediately before mounting the cylinder head.*
- ◆ *All of the coolant must be changed if the cylinder head was replaced.*
- ◆ *Intake manifold with fuel rail, removing and installing. Refer to ⇒ ["4.3 Intake Manifold with Fuel Rail, Removing and Installing", page 131](#).*

Conditions

- The engine must be no more than warm to touch.

Removing

- Drain the coolant. Refer to ⇒ ["1.4 Coolant, Draining and Filling", page 101](#).
- Remove the intake manifold with the fuel rail. Refer to ⇒ ["4.3 Intake Manifold with Fuel Rail, Removing and Installing", page 131](#).
- Remove the coolant hose from the cylinder head.
- Remove the coolant distribution housing -item 12- ⇒ [Item 12 \(page 106\)](#) with the coolant hoses.
- Disconnect the connector for the Heated Oxygen Sensor - G39- on the bulkhead -item 14- ⇒ [Item 14 \(page 119\)](#) and free up the wiring harness.
- Disconnect all other electric wires from the cylinder head and free them up.
- Remove the front exhaust pipe from the exhaust manifold.
- Remove the ribbed belt. Refer to ⇒ ["1.2 Ribbed Belt, Removing and Installing", page 31](#).
- Remove the ribbed belt tensioning damper.
- Remove the upper toothed belt guard.
- Turn the crankshaft the direction of engine rotation and move the camshaft sprocket to TDC cylinder 1.
- The marking on camshaft sprocket must line up with the arrow on toothed belt guard -arrows-.
- Loosen the tensioning roller and remove the toothed belt from the camshaft sprocket.
- Then turn the crankshaft slightly backward.
- Remove the cylinder head cover.
- Remove the upper bolt on the rear toothed belt guard.
- Loosen and remove cylinder head bolts in specified sequence.





- Carefully lift cylinder head off.

Installing

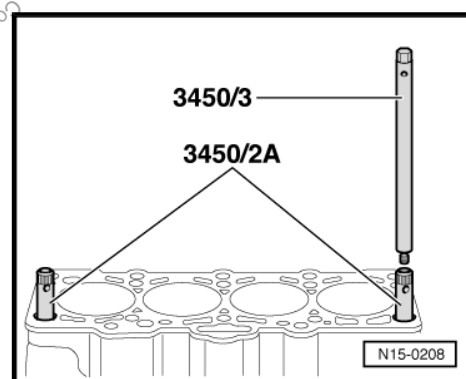
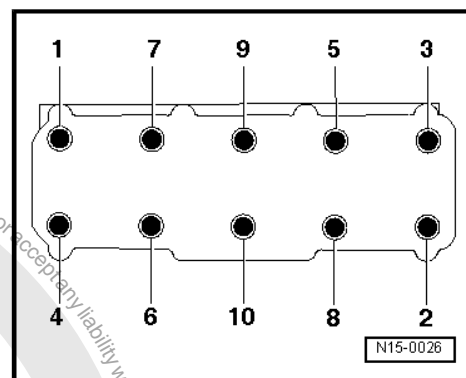


Note

- ◆ Always replace the bolts.
- ◆ There must be no oil or coolant in the blind holes for the cylinder head bolts in the cylinder block.
- ◆ Only unpack new cylinder head gasket immediately prior to installation.
- ◆ Handle new gasket with extra care. Damaging will lead to leaks.
- ◆ Stuff clean cloths into cylinder so that no dirt or abrasive powder can get between cylinder wall and piston.
- ◆ Do not allow dirt or abrasive powder to get into coolant either.
- ◆ Carefully clean the sealing surfaces on the cylinder head and on the cylinder block. Make sure that no long scrapes or scratches result. When using sand paper, grit must not be below 100.
- ◆ Carefully remove metal particles, emery remains and cloths.

In the event the crankshaft has been rotated in the meantime:

- Set piston of cylinder 1 to TDC and turn crankshaft back again slightly.
- To center, install the -3450/2A- in the front outer holes for the cylinder head bolts.
- Install the new cylinder head gasket.
- Set cylinder head in place.
- Install the remaining 8 cylinder head bolts hand-tight.
- Remove the guide pins through the bolt holes using the -3450/3-. Do this by turning the extractor toward the left until the bolts are free.
- Install both remaining cylinder head bolts hand-tight.





- Tighten cylinder head in tightening sequence as follows:

Step	Bolts	Tightening Specification/Additional Turn
1.	-1 through 10-	40 Nm
2.	-1 through 10-	Turn an additional 90°.
3.	-1 through 10-	Turn an additional 90°.

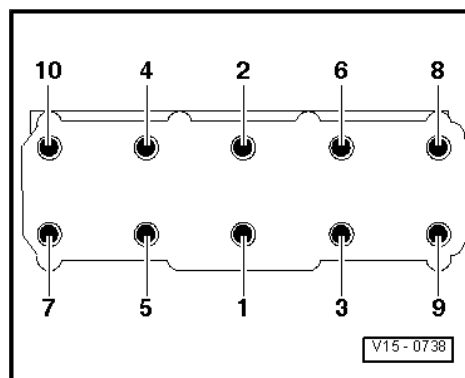
Assemble in reverse order of disassembly.



Caution

Danger of causing damage to the pistons and the valves.

- ***When turning camshaft, pistons may not be at TDC for any cylinder.***



- Install the toothed belt. Refer to [⇒ "2.2 Toothed Belt, Removing and Installing", page 59](#).
 - Install the ribbed belt tensioning element.
 - Install the ribbed belt. Refer to [⇒ "1.2 Ribbed Belt, Removing and Installing", page 31](#).
 - Install the intake manifold with the fuel rail. Refer to [⇒ "4.3 Intake Manifold with Fuel Rail, Removing and Installing", page 131](#).
 - Connect the battery. Refer to [⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery, Disconnecting and Connecting](#).
 - Fuel system, bleeding. Refer to [⇒ "1.2 Fuel System, Filling/Bleeding", page 119](#).
 - Fill with coolant. Refer to [⇒ "1.4 Coolant, Draining and Filling", page 101](#).
 - Erase the adaptation values and adapt the engine control module to the throttle valve control module see Vehicle Diagnostic Tester "Guided Fault Finding" function.
 - Perform a vehicle system test see Vehicle Diagnostic Tester "Guided Fault Finding" function.
 - End the vehicle system test in such a way that possibly existing DTC entries are automatically erased.
 - Perform a road test.
- Follow all safety precautions that apply to road tests. Refer to [⇒ "1.2 Road Test with Testing Equipment Safety Precautions", page 2](#).
- Perform the vehicle system test once again.
 - Correct any faults.

Tightening Specifications

- ♦ Refer to [⇒ "1.1 Overview - Cylinder Block, Belt Pulley Side", page 30](#)

1.3 Compression Pressure, Checking

Special tools and workshop equipment required

- ♦ Spark Plug Removal Tool - 3122B-
- ♦ Puller - Spark Plug Connector - T10112A-



- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Compression Tester Kit - VAG1763-

Test Conditions

- Engine oil temperature must be at least 30 °C (86 °F).
- Voltage supply OK.
- All electrical consumers such as, for example, headlamps and rear window defogger, must be off.
- If vehicle is equipped with an A/C system, it must be switched off.
- For vehicles with an automatic transmission, the selector lever must be in "P" or "N".

Perform the Following Work

- Disconnect the connector -arrow- from the ignition coil.
- Disconnect the connectors from the outer fuel injectors.
- Remove the spark plug wires using the -T10112A- .
- Remove the spark plugs with -3122B- .
- Check the compression pressure using the -VAG1763- and -VAG1763/6- .



Note

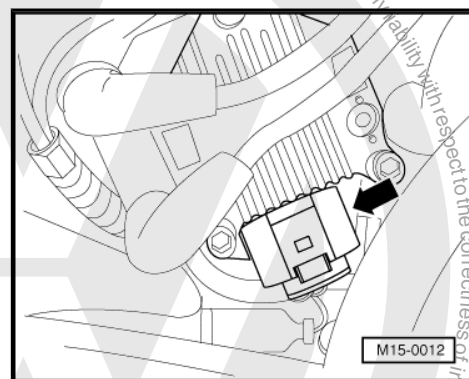
For information on using the tester, Refer to the Operating Instructions.

- Have a second technician operate the starter.
- Operate the starter until tester shows no further pressure increase.

Compression Pressure

MKB	New Positive Pressure	Wear Limit Positive Pressure	Difference between Cylinders Bar Positive Pressure
CBPA	10.0 to 13.0 bar (160 to 188.54 psi)	7.7 bar (111.67 psi)	maximum 3.0 bar (43.5 psi)
CKJA	14.0 to 17.0 bar (203 to 246.56 psi)	9.8 bar (142.13 psi)	maximum 3.0 bar (43.5 psi)

- Check the engine control module DTC memory and correct any faults. Then erase the DTC memory. Refer to [page 137](#) .





2 Toothed Belt Drive

⇒ [“2.1 Overview - Toothed Belt”, page 58](#)

⇒ [“2.2 Toothed Belt, Removing and Installing”, page 59](#)

⇒ [“2.3 Toothed Belt Drive Tensioner, Checking”, page 63](#)

2.1 Overview - Toothed Belt

1 - Bolt

- ☐ 45 Nm

2 - Engine Support

3 - Bolt

- ☐ Container bracket for power steering fluid; Tightening specification -item 3-
⇒ [Item 3 \(page 30\)](#)
- ☐ Belt pulley on pump; Tightening specification -item 3-
⇒ [Item 3 \(page 30\)](#)

4 - Mount

- ☐ For the power steering fluid reservoir

5 - Toothed Belt Guard Upper Section

6 - Toothed Belt Guard Center Part

7 - Nut/Bolt

- ☐ Nut tightening specification -item 7-
⇒ [Item 7 \(page 30\)](#)
- ☐ Bolt tightening specification -item 15-
⇒ [Item 15 \(page 52\)](#)

8 - Washer

9 - Tensioning Roller

- ☐ Checking the half automatic toothed belt tensioning roller. Refer to
⇒ [“2.3 Toothed Belt Drive Tensioner, Checking”, page 63](#) .

10 - Toothed Belt

- ☐ Mark direction of travel before removing
- ☐ Check for wear
- ☐ Do not kink
- ☐ Removing and installing. Refer to ⇒ [“2.2 Toothed Belt, Removing and Installing”, page 59](#) .

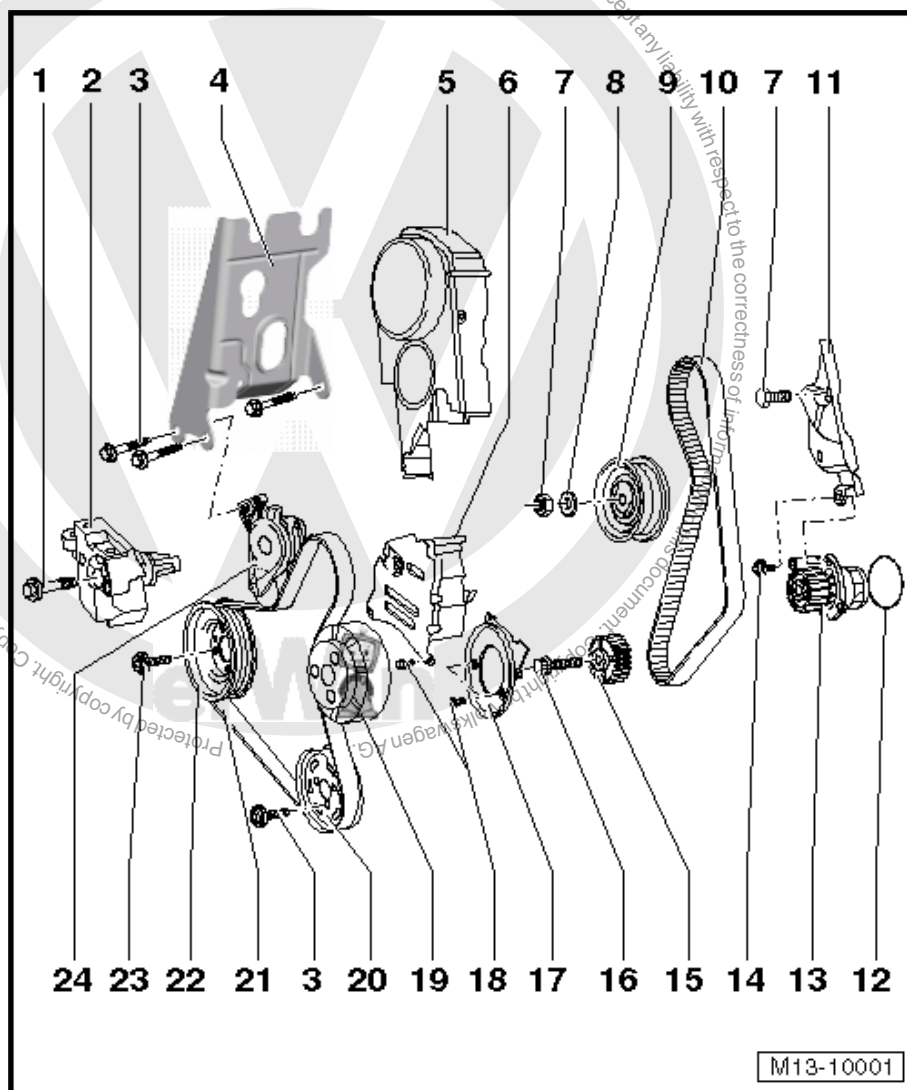
11 - Rear Toothed Belt Guard

12 - O-ring

- ☐ Replace after removing

13 - Coolant Pump

- ☐ Check for ease of movement





- ☐ Replace completely if damaged or leaking
- ☐ Removing and installing. Refer to ⇒ ["2.2 Coolant Pump, Removing and Installing", page 108](#) .

14 - Bolt

- ☐ 15 Nm

15 - Crankshaft Toothed Belt Sprocket

16 - Bolt

- ☐ 90 Nm +90°
- ☐ Replace after removing

17 - Toothed Belt Guard Lower Section

18 - Bolt

- ☐ 10 Nm
- ☐ Replace after removing

19 - Belt Pulley

- ☐ For A/C compressor

20 - Belt Pulley

- ☐ For power steering pump

21 - Ribbed Belt

- ☐ Mark direction of travel before removing
- ☐ Check for wear
- ☐ Do not kink
- ☐ Removing and installing. Refer to ⇒ ["1.2 Ribbed Belt, Removing and Installing", page 31](#) .

22 - Belt Pulley/Vibration Damper

- ☐ It is possible to install in one position only, the holes are offset asymmetrically.
- ☐ Note position when installing toothed belt. Refer to ⇒ ["2.2 Toothed Belt, Removing and Installing", page 59](#) .

23 - Bolt

- ☐ 25 Nm

24 - Ribbed Belt Tensioner

- ☐ To release tension on ribbed belt, pivot using a wrench. Refer to ⇒ ["1.2 Ribbed Belt, Removing and Installing", page 31](#) .

2.2 Toothed Belt, Removing and Installing

Special tools and workshop equipment required

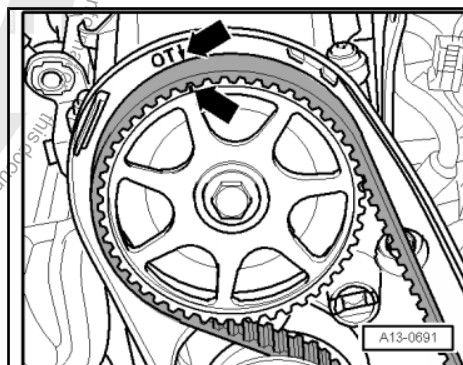
- ◆ Engine Support Bridge - 10-222A-
- ◆ Engine Support Bridge - Spindle - 10-222A/11-
- ◆ Engine Support Bridge - Engine Support 28 - 10-222A/28-
- ◆ Engine Support Bridge - Engine Support 31 - 10-222A/31-
- ◆ Rail with Holes - T40091/2- from the Engine Support - Basic Set - T40091-
- ◆ Mount - T40093/5- from the Engine Support - Supplement Kit - T40093A-
- ◆ Engine Support Bridge - Engine Support 28-2 - 10-222A/28-2- , quantity: 2
- ◆ Square Pipe - T40091/1- (quantity 2) from the Engine Support - Basic Set - T40091-



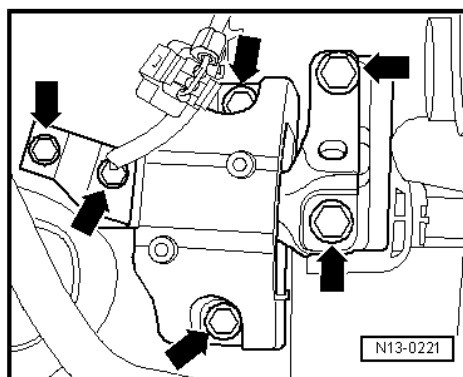
- ◆ Movable Joint - T40091/3- (quantity 2) from the Engine Support - Basic Set - T40091-
- ◆ Movable Joint - T40093/4- (quantity 2) from the Engine Support - Supplement Kit - T40091-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Toothed Belt Tensioner - T10020-

Removing

- Remove the noise insulation. Refer to ➤ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .
- Remove the ribbed belt. Refer to
➔ ["1.2 Ribbed Belt, Removing and Installing", page 31](#) .
- Remove the ribbed belt tensioning damper.
- Remove the coolant expansion tank. The coolant hoses remain connected.
- Remove the upper toothed belt guard.
- Turn the crankshaft the direction of engine rotation and move the camshaft sprocket to TDC cylinder 1.
- The marking on camshaft sprocket must line up with the arrow on toothed belt guard -arrows-.
- Support the engine in its installed position. Refer to
➔ ["2.3 Engine, Supporting in Installed Position", page 21](#) .

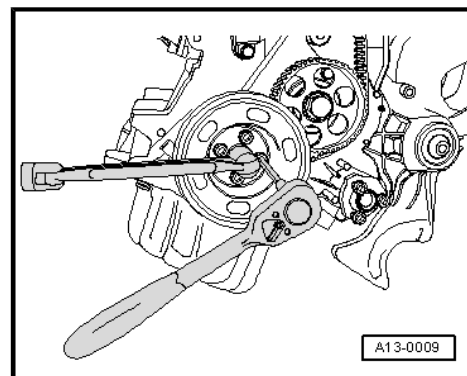


- Remove the engine mount bolts -arrows-.
- Remove the engine mount.





- Remove the belt pulley/vibration damper.



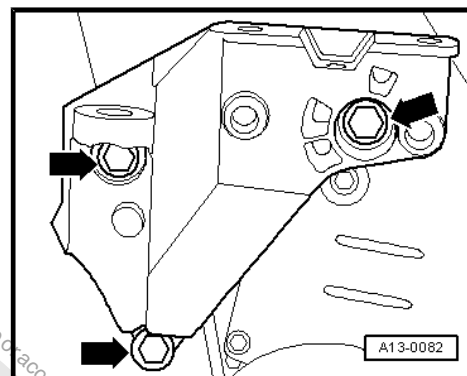
- Remove the engine support from the cylinder block.



Note

To loosen the front engine carrier bolt, the engine must be slightly lifted by the engine support bridge.

- Remove the lower and center toothed belt guards.
- Mark direction of rotation of toothed belt.
- Loosen the tensioning roller and remove the toothed belt.
- Then turn the crankshaft slightly backward.



Installing

Requirements



Caution

Danger of causing damage to the pistons and the valves.

- ***When turning camshaft, pistons may not be at TDC for any cylinder.***

- The engine must be no more than warm to touch.
- Route the toothed belt over toothed belt sprocket for the crankshaft and coolant pump. Pay attention to the rotation direction of the toothed belt.



Note

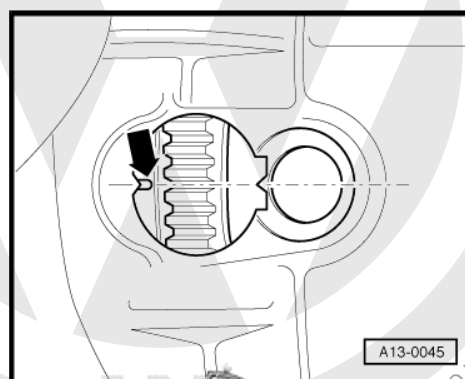
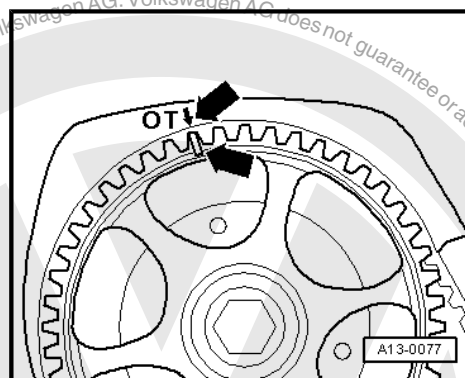
With the engine removed beforehand, install the toothed belt guard lower section as well as the vibration damper/belt pulley.



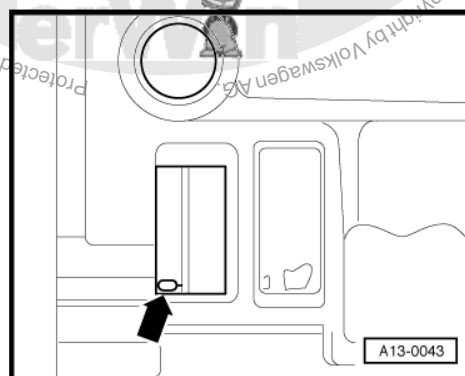
- Align marking on camshaft sprocket with marking on the toothed belt guard.

Engine is Installed

- Turn the crankshaft in direction of engine rotation to the upper TDC cylinder 1.



- ◆ Vehicles with a manual transmission
- ◆ Vehicles with an automatic transmission

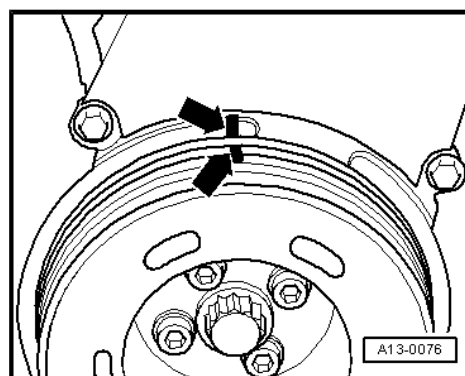


Engine Removed

- Set the belt pulley/vibration damper in direction of engine rotation at the upper dead center position of cylinder 1 -arrows-.

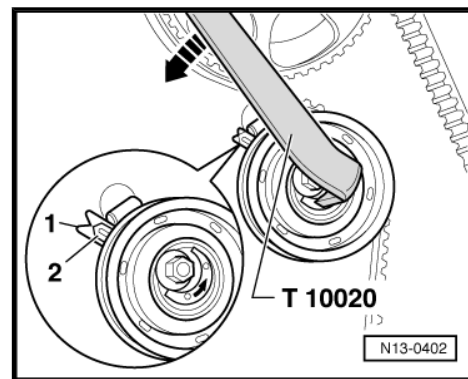
Continuation for All

- Lay toothed belt on tensioner and camshaft gear.
- Turn the tensioning roller at the eccentric pulley five times all the way in both directions using the -T10020- .





- Tension the toothed belt. To do so, turn the -T10020- on the eccentric pulley all the way to the left in direction of -arrow-.
- Then release the tension on the toothed belt until the notch -1- and the pointer -2- are opposite each other. Use a mirror.
- Tighten the nut.
- Turn crankshaft twice in the direction of engine rotation and then set at upper dead center position on cylinder 1 again.
- For this it is necessary that the last 45° is turned without interruption.
- Check tension of the toothed belt again.
- Specified value: the pointer and the notch must be opposite each other.



If the tension on the ribbed belt is OK:

- Install the lower and center toothed belt guards.
- Install the belt pulley/vibration damper.
- Attach the engine support to the cylinder block.



Note

Install the bolts into the engine support before installing it.

- Install the engine mount.
- Align engine and transmission mountings. Refer to [⇒ "2.4 Subframe Mount, Adjusting", page 24](#).
- Remove the -10-222A-.
- Install the upper toothed belt guard.
- Install the ribbed belt tensioning element.
- Install the ribbed belt. Refer to [⇒ "1.2 Ribbed Belt, Removing and Installing", page 31](#).

The further installation is performed in reverse order of removal.

Tightening Specifications

- ◆ Refer to [⇒ "2.1 Overview - Toothed Belt", page 58](#)
- ◆ Refer to [⇒ "1.1 Overview - Cylinder Block, Belt Pulley Side", page 30](#)
- ◆ Refer to [⇒ "2.1 Overview - Subframe Mount", page 17](#)

2.3 Toothed Belt Drive Tensioner, Checking

Special tools and workshop equipment required

- ◆ Toothed Belt Tensioner - T10020-



Test Prerequisites

- The bracket -arrow- must engage into the cut-out in the cylinder head.
- The engine must be no more than warm to touch.

Perform the Following Work

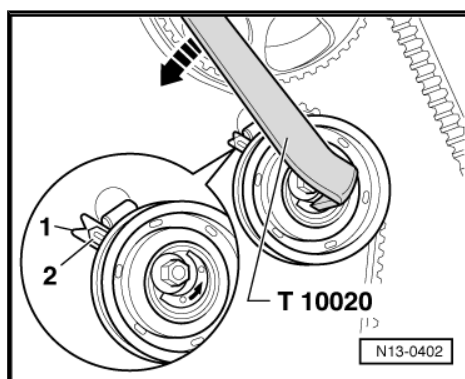
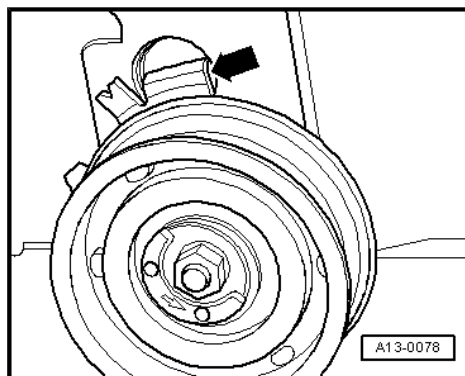
- Turn the engine to upper TDC cylinder 1.
- Place a load on the toothed belt with strong thumb pressure.

- The arrow -2- must move.
- Release load on toothed belt again.
- Turn crankshaft over twice in engine running direction until the crankshaft is at upper TDC cylinder one again.
- For this it is necessary that the last 45° is turned without interruption.
- The tensioning roller must return to its initial position. The notch -1- and the pointer -2- must align again.



Note

Use a mirror to check.





3 Valvetrain

⇒ [“3.1 Overview - Valvetrain”, page 65](#)

⇒ [“3.2 Camshaft Seal, Removing and Installing”, page 68](#)

⇒ [“3.3 Camshaft, Removing and Installing”, page 70](#)

⇒ [“3.4 Hydraulic Adjusting Elements, Checking”, page 71](#)

⇒ [“3.5 Valve Stem Seals, Removing and Installing”, page 72](#)

3.1 Overview - Valvetrain



Note

- ◆ *Cylinder heads with cracks between the valve seats, or between the valve seat and the spark plug threads, can continue to be used without reducing the service life, as long as the cracks have a width of max. 0.3 mm, or only the first 4 threads of the spark plug threads are cracked.*
- ◆ *After installing new hydraulic valve lifters, the engine may not be started for approximately 30 minutes. Otherwise the valves will impact the pistons.*
- ◆ *Turn over the engine carefully at least two turns after working on the valvetrain. This assures the valve do not strike the piston when starting the engine.*



1 - Bolt

- ☐ 100 Nm

2 - Camshaft Sprocket

3 - Seal

- ☐ Replacing. Refer to
⇒ ["3.2 Camshaft Seal, Removing and Installing", page 68](#) .

4 - Woodruff Key

- ☐ Make sure it is secure

5 - Bolt

- ☐ 20 Nm

6 - Bearing Cap

- ☐ Installed position. Refer to
⇒ [Fig. "Installed Position of Camshaft Bearing Caps", page 68](#)
- ☐ Installation sequence. Refer to
⇒ ["3.3 Camshaft, Removing and Installing", page 70](#) .

7 - Camshaft

- ☐ Axial play, checking. Refer to
⇒ [Fig. "Camshaft, Checking Axial Play", page 67](#) .
- ☐ Removing and installing. Refer to
⇒ ["3.3 Camshaft, Removing and Installing", page 70](#) .

- ☐ Check radial clearance with Plastigauge®

Wear limit: 0.1 mm

Run-out: max. 0.05 mm

8 - Hydraulic Valve Lifter

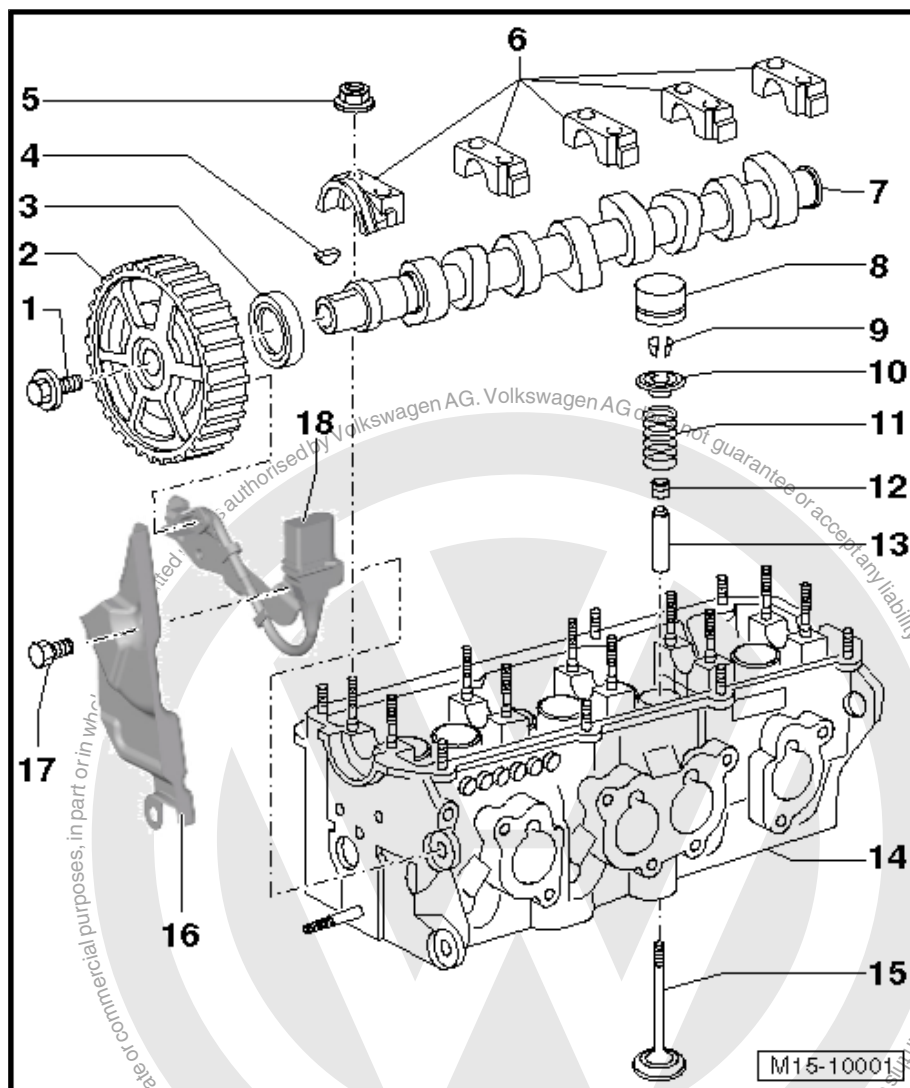
- ☐ Do not interchange
- ☐ With hydraulic valve clearance compensation
- ☐ Checking. Refer to ⇒ ["3.4 Hydraulic Adjusting Elements, Checking", page 71](#) .
- ☐ Place on running surface when setting down
- ☐ Before installing, check axial play of camshafts. Refer to
⇒ [Fig. "Camshaft, Checking Axial Play", page 67](#)
- ☐ Lubricate contact surface

9 - Valve Retainers

10 - Upper Valve Spring Retainer

11 - Valve Spring

- ◆ Removing and installing:
- ◆ Cylinder head removed using Valve Spring Compressor - 2037-
- ◆ Cylinder head installed. Refer to ⇒ ["3.5 Valve Stem Seals, Removing and Installing", page 72](#) .





12 - Valve Stem Seal

- ☐ Replacing. Refer to ➔ [“3.5 Valve Stem Seals, Removing and Installing”, page 72](#) .

13 - Valve Guide

- ☐ Checking. Refer to ➔ [“4.2 Valve Guides, Checking”, page 75](#) .
- ☐ Replacing. Refer to ➔ [“4.3 Valve Guides, Replacing”, page 76](#) .
- ☐ Repair guide with shoulder

14 - Cylinder Head

- ☐ Resurfacing sealing surfaces. Refer to
➔ [Fig. “Cylinder Head - Sealing Surface, Resurfacing””, page 67](#)
- ☐ Valve Seats, Reworking. Refer to ➔ [“4.1 Valve Seats, Reworking”, page 74](#) .

15 - Valves

- ☐ Do not rework, only lapping is permitted
- ☐ Valve dimensions. Refer to ➔ [Fig. “Valve Dimensions””, page 68](#)

16 - Rear Toothed Belt Guard

17 - Bolt

- ☐ 20 Nm

18 - Camshaft Position Sensor - G40-

Cylinder Head - Sealing Surface, Resurfacing

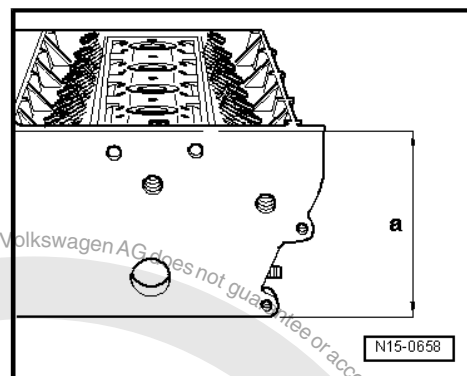
Reworking dimension, cylinder head:

- -a- = minimum 132.6 mm

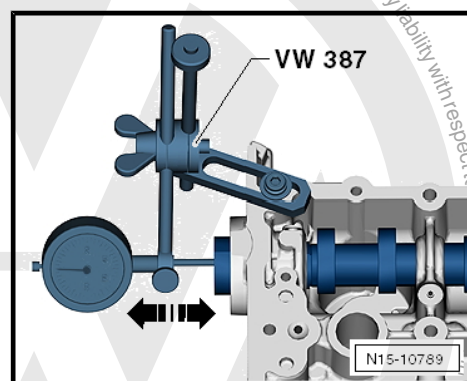


Note

If the sealing surfaces are reworked, the valves must be set deeper at the same dimension. Rework the valve seat ring. Otherwise the valve will hit up against the pistons. Be careful not to exceed the minimum dimension. Refer to ➔ [“4.1 Valve Seats, Reworking”, page 74](#) .



Camshaft, Checking Axial Play



Special tools and workshop equipment required

- ◆ Dial Gauge Holder - VW387-
- ◆ Dial gauge

Test Sequence

- Measure with valve lifters removed and with first and last bearing cap installed.

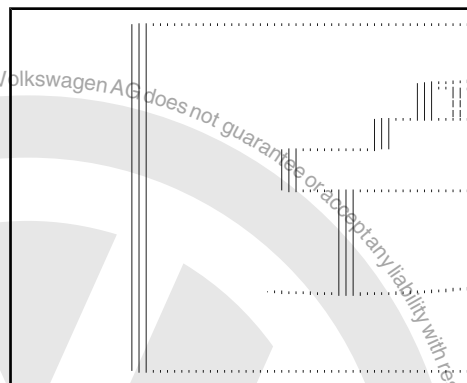


- Wear limit: 0.15 mm.

Installed Position of Camshaft Bearing Caps

Observe central alignment.

- Before installing camshaft, set bearing caps in place and determine installation position.



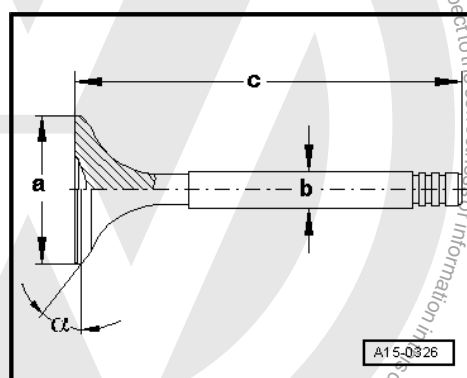
Valve Dimensions



Note

Valves must not be reworked. Only lapping is permitted.

Dimension		Intake Valve	Exhaust Valve
Diameter a	mm	39.50 ± 0.15	32.90 ± 0.15
Diameter b	mm	6.92 ± 0.02	6.92 ± 0.02
c	mm	91.85	91.15
α	°	45	45



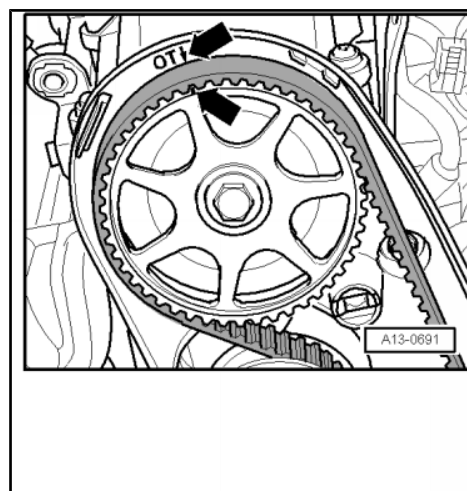
3.2 Camshaft Seal, Removing and Installing

Special tools and workshop equipment required

- ◆ Puller - Camshaft Seal - 2085-
- ◆ Counterhold - Crankshaft Sprocket - 3415-
- ◆ Seal Installer - Camshaft - T10071-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Torque Wrench 1332 40-200Nm - VAG1332-

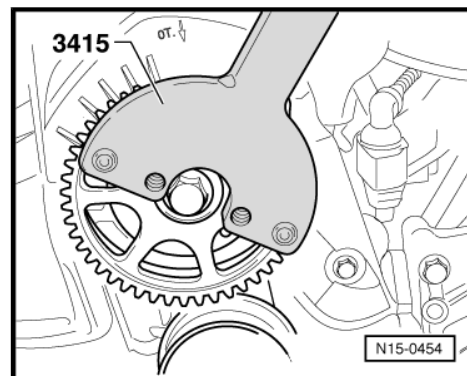
Removing

- Remove the upper toothed belt guard.
- Turn the crankshaft the direction of engine rotation and move the camshaft sprocket to TDC cylinder 1.
- The marking on camshaft sprocket must line up with the arrow on toothed belt guard -arrows-.
- Loosen the tensioning roller and remove the toothed belt from the camshaft sprocket.
- Then turn the crankshaft slightly backward.

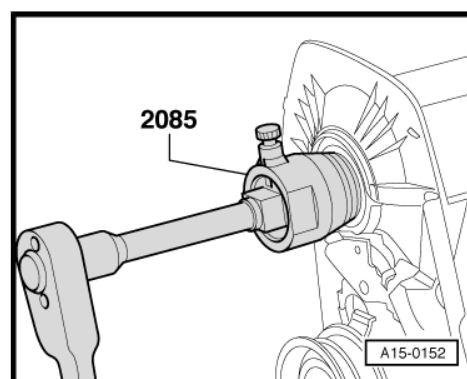




- Remove the camshaft sprocket. To loosen the bolt, hold the camshaft sprocket firmly using the -3415- .
- Remove woodruff key from the camshaft.
- Install the mounting bolt for the camshaft gear all the way into the camshaft.
- Remove the inner portion of -2085- two rotations (approximately 3 mm) from outer portion and secure with knurled-head screw.



- Lubricate the threaded head on the -2085- position it and install it as far as possible into the seal using force.
- Loosen knurled bolt and turn inner part against camshaft until seal is removed.
- Tension the -2085- in a vise at the flat spots. Remove seal with pliers.



Installing

Conditions

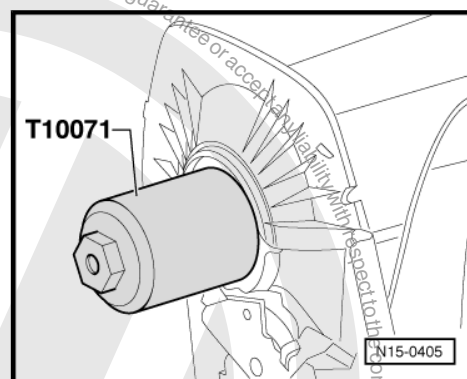
- The pistons must not be positioned at TDC.



Note

Do not lubricate or grease the sealing lip on the seal.

- Position the seal using the -T10071- and press it in all the way using the -T10071/1- and -T10071/2- .
- Insert the coil spring into the camshaft.



- Install camshaft sprocket. To tighten the bolt, hold the camshaft sprocket firmly using the -3415- .

Tightening Specifications

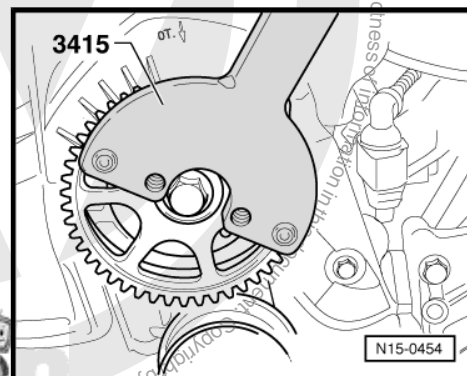
- ◆ Refer to ⇒ [“3.1 Overview - Valvetrain”, page 65](#)



Caution

Danger of causing damage to the pistons and the valves.

- ***When turning camshaft, pistons may not be at TDC for any cylinder.***



Assemble in reverse order of disassembly.

- Install the toothed belt. Refer to ⇒ [“2.2 Toothed Belt, Removing and Installing”, page 59](#) .



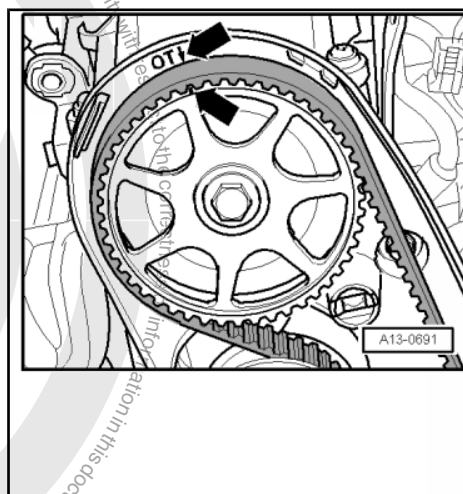
3.3 Camshaft, Removing and Installing

Special tools and workshop equipment required

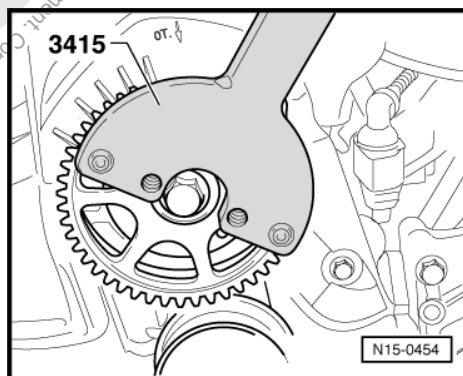
- ◆ Counterhold - Crankshaft Sprocket - 3415-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Torque Wrench 1332 40-200Nm - VAG1332-
- ◆ For the correct sealant. Refer to the Parts Catalog.

Removing

- Remove the upper toothed belt guard.
- Turn the crankshaft in the direction of engine rotation and move the camshaft sprocket to TDC cylinder 1.
- The marking on camshaft sprocket must line up with the arrow on toothed belt guard -arrows-.
- Loosen the tensioning roller and remove the toothed belt from the camshaft sprocket.
- Then turn the crankshaft slightly backward.



- Remove the camshaft sprocket. To loosen the bolt, hold the camshaft sprocket firmly using the -3415-.
- Remove woodruff key from the camshaft.
- Remove the cylinder head cover.
- Remove bearing caps 5, 1 and 3 first. Loosen bearing caps 2 and 4 in alternation and in diagonal sequence.



Note

The numbers are stamped into the bearing cap.

Installing

Conditions

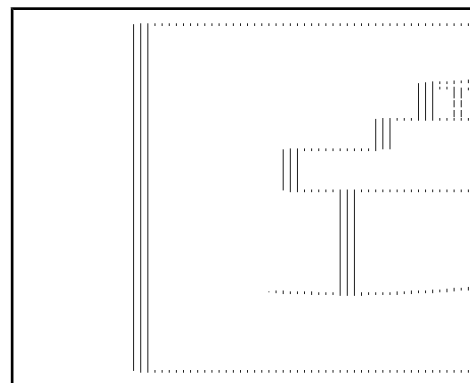
- The pistons must not be positioned at TDC.
- When installing the camshafts, the cam lobes for cylinder 1 must point upward.



Note

When installing, make sure the bearing cap is centrally positioned. Before installing, set bearing caps in place and determine installation position.

- Lubricate the running surfaces of both camshaft.
- Install the camshaft.
- Tighten bearing caps 2 and 4 alternating in a diagonal sequence.
- Coat the contact surfaces from the first bearing cap with sealant. Refer to the Parts Catalog.
- Install bearing cap 3, 1 and 5 and tighten them.
- Mount the woodruff key into the camshaft.
- Install camshaft sprocket. To tighten the bolt, hold the camshaft sprocket firmly using the -3415-



Tightening Specifications

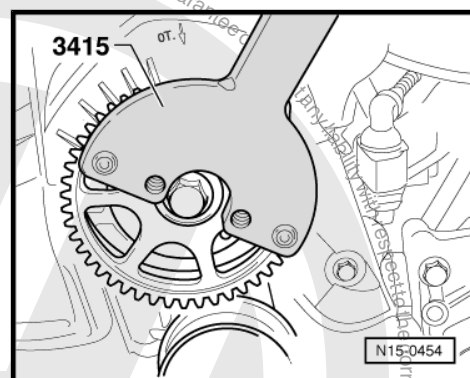
- ◆ Refer to ⇒ [“3.1 Overview - Valvetrain”, page 65](#)



Caution

Danger of causing damage to the pistons and the valves.

- ***When turning camshaft, pistons may not be at TDC for any cylinder.***



Assemble in reverse order of disassembly.

- Install the toothed belt. Refer to ⇒ [“2.2 Toothed Belt, Removing and Installing”, page 59](#).



Note

After installing new hydraulic valve lifters, the engine may not be started only after approximately 30 minutes. Hydraulic equalization elements must seat themselves. Otherwise the valves will impact the pistons.

3.4 Hydraulic Adjusting Elements, Checking

Special tools and workshop equipment required

- ◆ Feeler Gauge
- ◆ Wooden or plastic wedge



Note

- ◆ *Only replace the entire hydraulic valve lifter and it cannot be adjusted or serviced.*
- ◆ *Irregular valve noises are normal while starting the engine.*



Perform the Following Work

- Start the engine and let it run until the coolant fan comes on one time.
- Increase the RPM to approximately 2,500 for two minutes.

If the hydraulic valve lifters are still noisy, determine which lifter is defective as follows:

- Remove the intake manifold with the fuel rail. Refer to [⇒ “4.3 Intake Manifold with Fuel Rail, Removing and Installing”, page 131](#).
- Remove the cylinder head cover.
- Turn crankshaft clockwise until camshaft lobe for valve lifter to be tested is pointing upward.
- Check clearance between cam lobes and valve lifters.

If the play exceeds 0.2 mm:

- Replace the valve lifter.

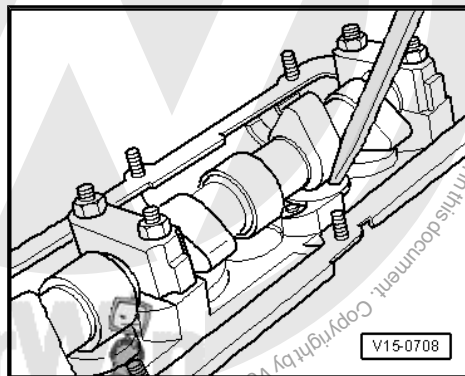
If minimal play of 0.1 mm or no play is measured, continue the procedure as follows:

- Lightly press the valve lifter downward with a wood or plastic wedge.
- If 0.20 mm thick feeler gauge can be inserted between camshaft and valve lifter, the valve lifter must be replaced.



Note

After installing new hydraulic valve lifters, the engine may not be started for approximately 30 minutes. Hydraulic equalization elements must seat themselves. Otherwise the valves will impact the pistons.



3.5 Valve Stem Seals, Removing and Installing

Special tools and workshop equipment required

- ◆ Seal Installer - Valve Stem Seal Tool - 2036-
- ◆ Slide Hammer - 3047A-
- ◆ Spark Plug Removal Tool - 3122B-
- ◆ Seal Installer - Valve Stem - 3129-
- ◆ Puller - Spark Plug Connector - T10112A-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Valve Lever - VW541/1A-
- ◆ Valve Lever - Press Tool 5 - VW541/5-
- ◆ Pressure Hose - VW653/3-

Perform the Following Work

Removing

- Remove the camshaft. Refer to [⇒ “3.3 Camshaft, Removing and Installing”, page 70](#).
- Remove the hydraulic valve lifter and lay it down with the contact surface facing down. Be careful not to switch valve lifters.



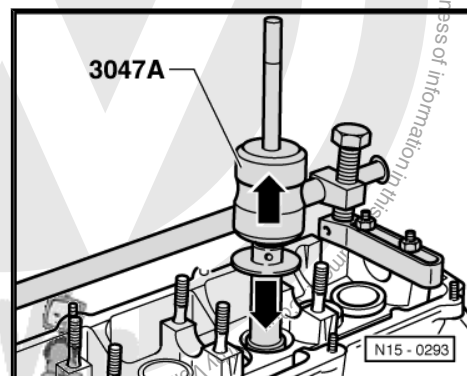
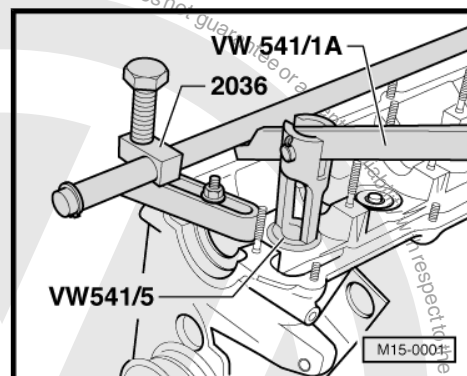
- Remove the spark plug wires using the -T10112A- .
- Remove the spark plugs using the -3122B- .
- Move piston for that cylinder to “bottom dead center position”.
- Insert the -2036- and adjust the mounting to the stud height.
- Install the -VW653/3- in the spark plug thread.
- Connect the pressure hose to compressed air at minimum 6 bar (87 psi).
- Remove the valve springs using the -VW541/1A- and -VW541/5- .



Note

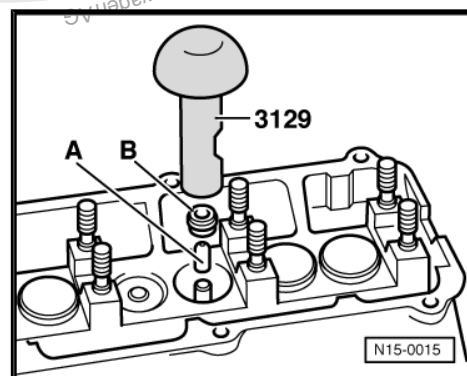
Tight valve retainers can be loosened by tapping lightly on the lever.

- Remove the valve stem seals using the -3047A- .



Installing

- Attach the plastic sleeve provided -A- to the valve stem. This prevents the new valve stem seal -B- from getting damaged.
- Insert the new valve stem seal into the -3129- .
- Grease lip of valve stem seal and carefully slide onto valve guide.





4 Intake and Exhaust Valves

⇒ "4.1 Valve Seats, Reworking", page 74

⇒ "4.2 Valve Guides, Checking", page 75

⇒ "4.3 Valve Guides, Replacing", page 76

4.1 Valve Seats, Reworking

Special tools and workshop equipment required

- ◆ Depth Gauge
- ◆ Valve Seat Refacing Tool



Note

- ◆ *Cylinder heads with cracks between the valve seats, or between the valve seat and the spark plug threads, can continue to be used without reducing the service life, as long as the cracks have a width of max. 0.3 mm, or only the first 4 threads of the spark plug threads are cracked.*
- ◆ *After installing new hydraulic valve lifters, the engine may not be started for approximately 30 minutes. Otherwise the valves will impact the pistons.*
- ◆ *Turn over the engine carefully at least two turns after working on the valvetrain. This assures the valve do not strike the piston when starting the engine.*

Perform the Following Work



Note

- ◆ *When repairing engines with leaking valves, it is not sufficient to rework or replace valve seats and valves. It is particularly important to check valve guides for wear on engines with longer running times.*
- ◆ *Only reface valve seats enough until a perfect contact pattern is obtained. The maximum permissible reworking dimension must be calculated before work is carried out. If the reworking dimension is exceeded, the function of the hydraulic lifters can no longer be guaranteed. Then replace the cylinder head.*

Calculate the Maximum Reworking Dimension

- Insert valve and press firmly against seat.



Note

If the valve was replaced during a repair, a new valve must be used to measure.



- Measure distance -a- between end of valve stem and upper edge of cylinder head.
- Calculate maximum permissible reworking dimension from measured distance -a- and minimum dimension.

Minimum dimensions

Intake valve: 33.8 mm

Exhaust valve: 34.1 mm

Measured distance -a- minus minimum dimension

= Max. permissible reworking dimension

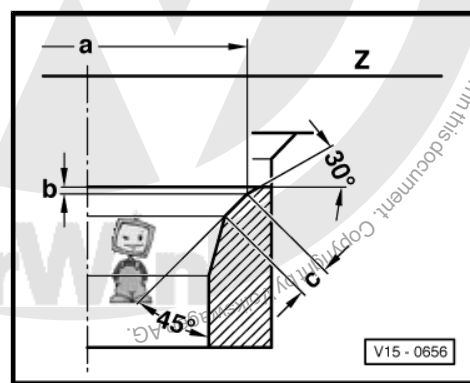
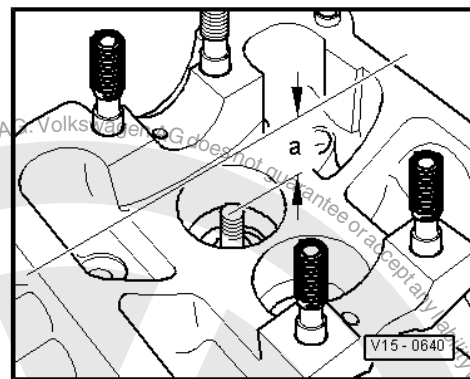
Example

Measured distance -a-	35.1 mm
- Minimum dimension	34.1 mm
= maximum permitted reworking dimension	1.0 mm
1)	

1) Maximum allowable refacing dimension is represented in illustrations for refacing valve seats as dimension "b".

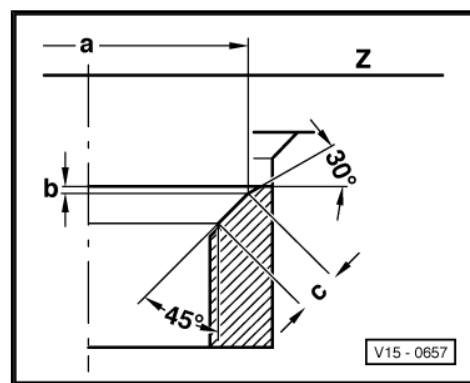
Reworking Intake Valve Seat

Dimension		Intake Valve Seat
Diame-ter a	mm	39.2
b	mm	Maximum permissible reworking dimension
c	mm	1.8 to 2.2
Z		Cylinder Head Lower Edge
45°		Valve seat angle
30°		Upper correction angle



Reworking Exhaust Valve Seat

Dimension		Exhaust Valve Seat
Diame-ter a	mm	32.4
b	mm	Maximum permissible reworking dimension
c	mm	2.2 to 2.6
Z		Cylinder Head Lower Edge
45°		Valve seat angle
30°		Upper correction angle



4.2 Valve Guides, Checking

Special tools and workshop equipment required

- ◆ Dial Gauge Holder - VW387-
- ◆ Dial Gauge



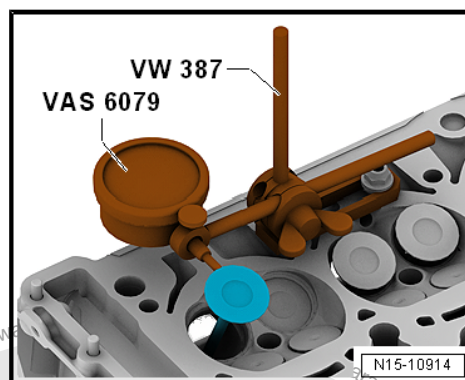
Perform the Following Work

- Insert the new valve into the guide.
- The end of the valve stem must be flush with the guide.
Due to the slight difference in stem dimensions, ensure that only an intake valve is used in the intake guide and an exhaust valve in the exhaust guide.
- Determine tip clearance.

Wear limits

Intake valve seat: 1.0 mm

Exhaust valve seat: 1.3 mm



4.3 Valve Guides, Replacing

Special tools and workshop equipment required

- ◆ Valve Guide Drift - 3121-
- ◆ Valve Guide Reamer - 7mm - 3120-
- ◆ Cutting oil

Perform the Following Work

Removing

- Cleaning and checking cylinder head.

Do not re-work the cylinder heads any more:

- ◆ If the valve seat rings cannot be re-worked any more. Pay attention to the minimum dimensions. Refer to [⇒ "4.1 Valve Seats, Reworking", page 74](#)
- ◆ If the sealing surface was worked to the minimum dimension -a-.



Reworking dimension, cylinder head:

- -a-: minimum 132.6 mm



Note

◆ If the sealing surfaces are reworked, the valves must be set deeper at the same dimension. The valve seat rings must be re-worked. Otherwise the valve will hit up against the pistons.

◆ Be careful not to exceed the minimum dimension. Refer to ⇒ ["4.1 Valve Seats, Reworking", page 74](#) .

- Remove any worn valve guides from the camshaft side using a -3121- .

Remove worn valve guides from the combustion side with the shouldered repair guide.

Installing

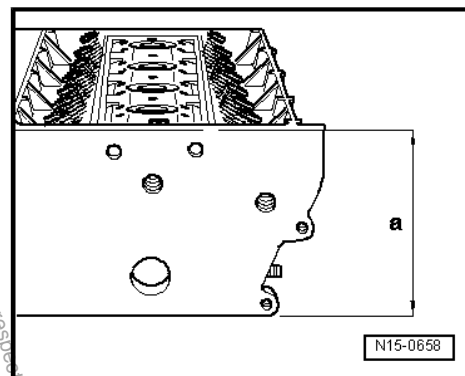
- Replace the valve guides and coat them with oil.
- Press the guides from the camshaft side up to the collar in the cold cylinder head using the -3121- .



Caution

After the guide with the collar is seated, the pressing force may not be increased over 10 kN. Otherwise the collar could break off.

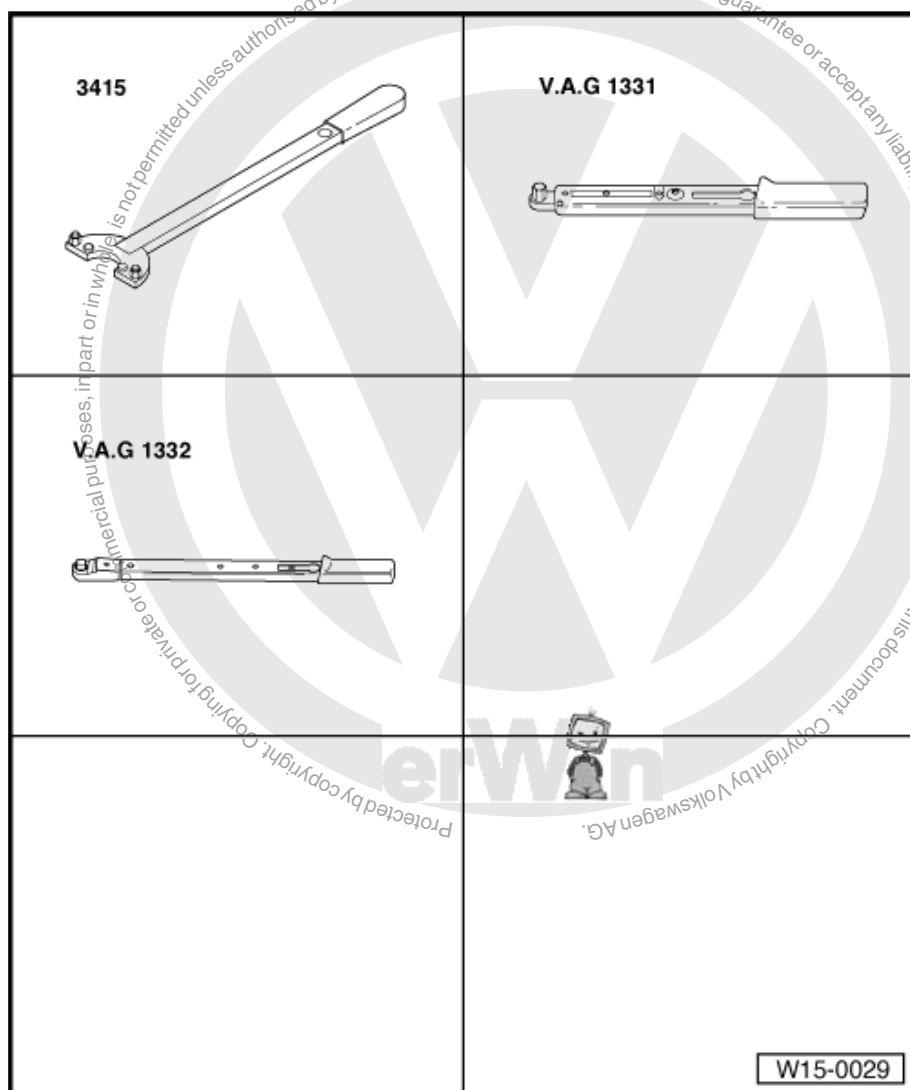
- Ream the valve guide using the -3120- .
- Always use cutting oil for this.
- Valve seats, reworking. Refer to ⇒ ["4.1 Valve Seats, Reworking", page 74](#) .



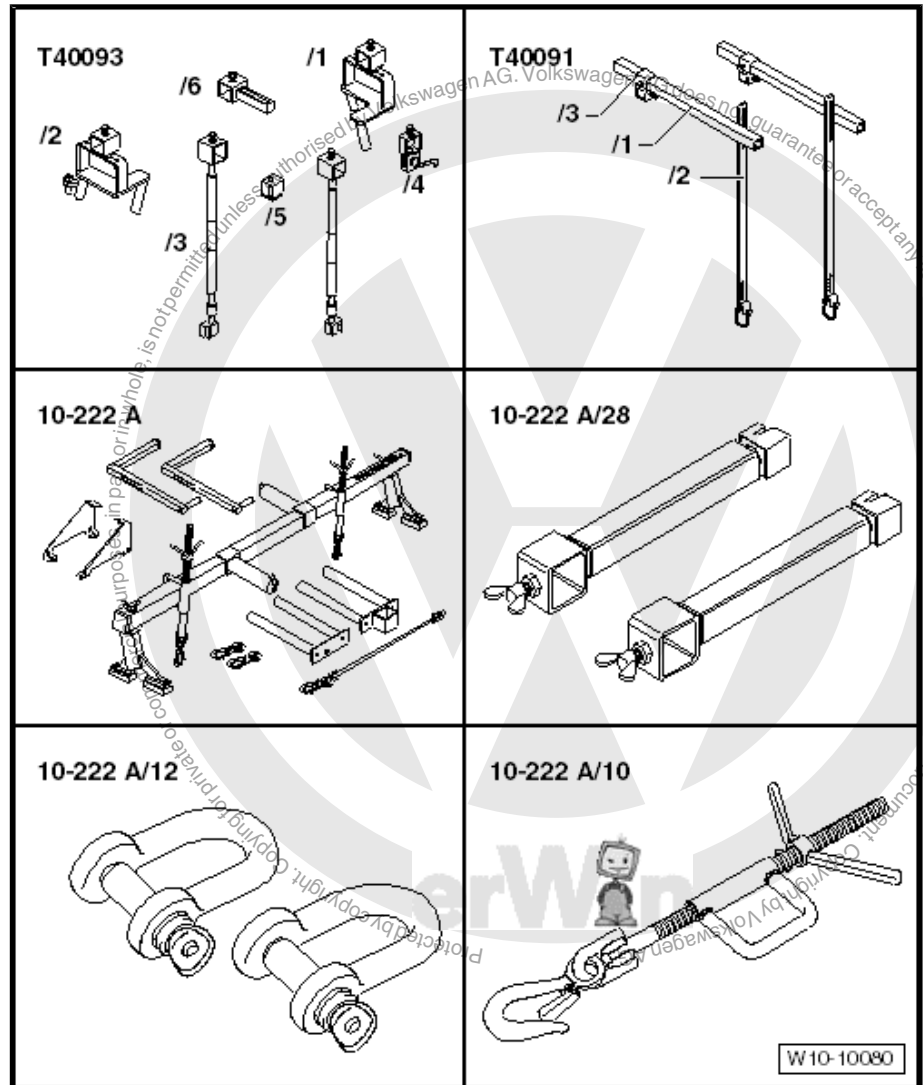


5 Special Tools

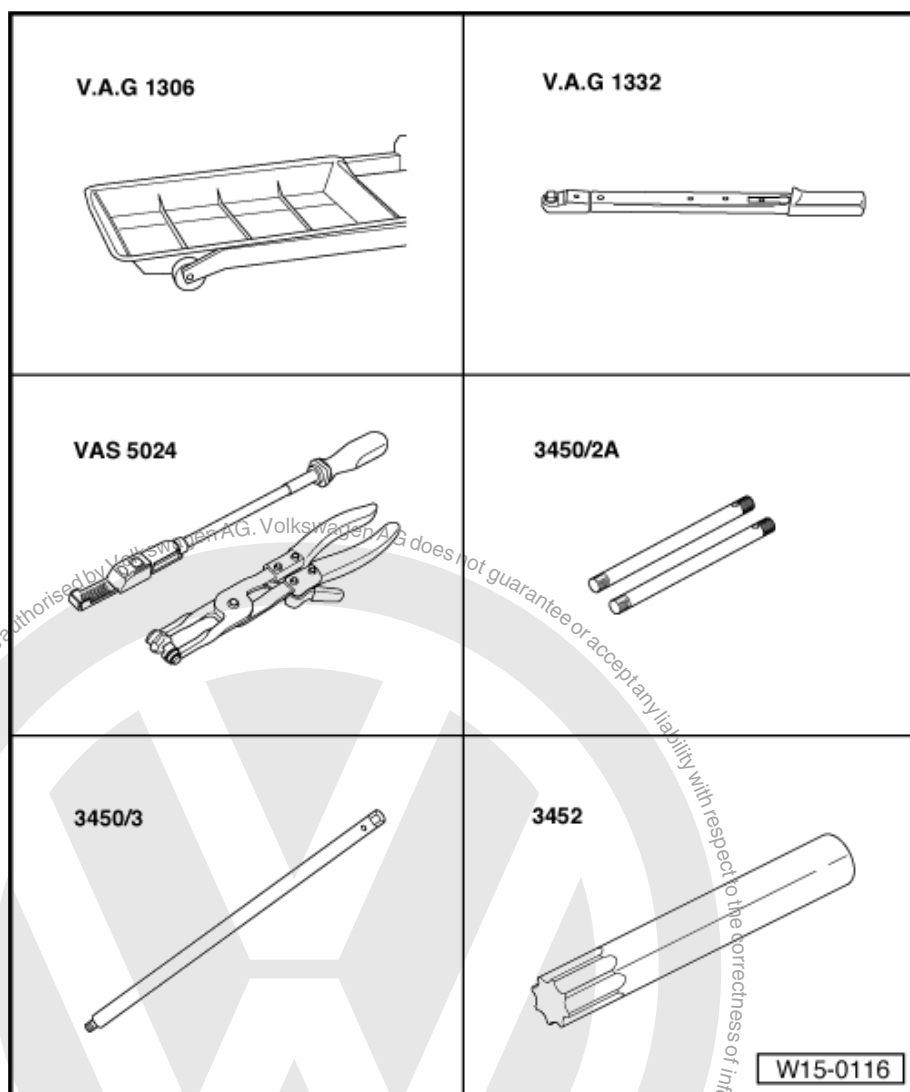
Special tools and workshop equipment required



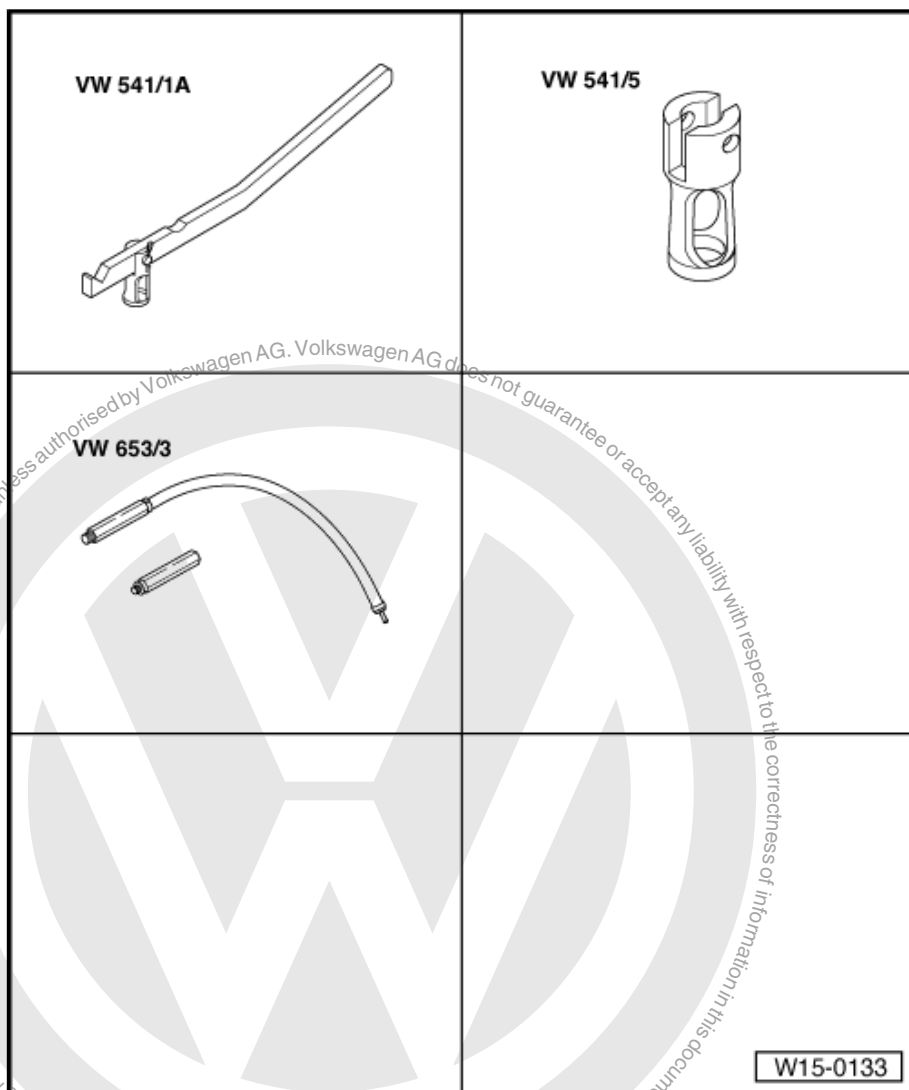
- ◆ Counterhold - Crankshaft Sprocket - 3415-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Torque Wrench 1332 40-200Nm - VAG1332-
- ◆ For the correct sealant. Refer to the Parts Catalog.



- ◆ Engine Support Bridge - 10-222A-
- ◆ Engine Support Bridge - Spindle - 10-222A/11-
- ◆ Engine Support Bridge - Engine Support 28 - 10-222A/28-
- ◆ Engine Support Bridge - Engine Support 31 - 10-222A/31-
- ◆ Rail with Holes - T40091/2- from the Engine Support - Basic Set - T40091-
- ◆ Mount - T40093/5- from the Engine Support - Supplement Kit - T40093A-
- ◆ Engine Support Bridge - Engine Support 28-2 - 10-222A/28-2- , quantity: 2
- ◆ Square Pipe - T40091/1- (quantity 2) from the Engine Support - Basic Set - T40091-
- ◆ Movable Joint - T40091/3- (quantity 2) from the Engine Support - Basic Set - T40091-
- ◆ Movable Joint - T40093/4- (quantity 2) from the Engine Support - Supplement Kit - T40091-

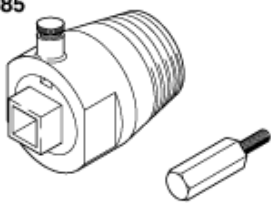
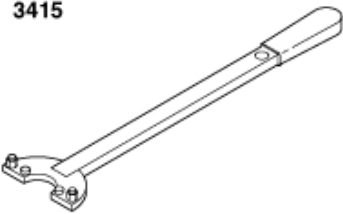
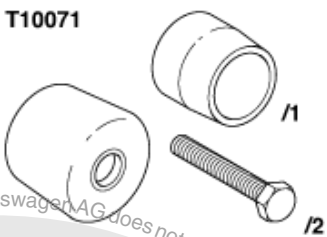

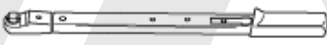


- ◆ Instrument/Gauge Tester - VAG1306- or Shop Crane - Drip Tray - VAS6208-
- ◆ Torque Wrench 1332 40-200Nm - VAG1332 -
- ◆ Hose Clip Pliers VAS5024A
- ◆ Head Gasket Alignment Tool - Pins - 3450/2A-
- ◆ Head Gasket Alignment Tool - Rod - 3450/3-
- ◆ Wrench - 3452- or Polydrive Bit Drive Socket - T10070-

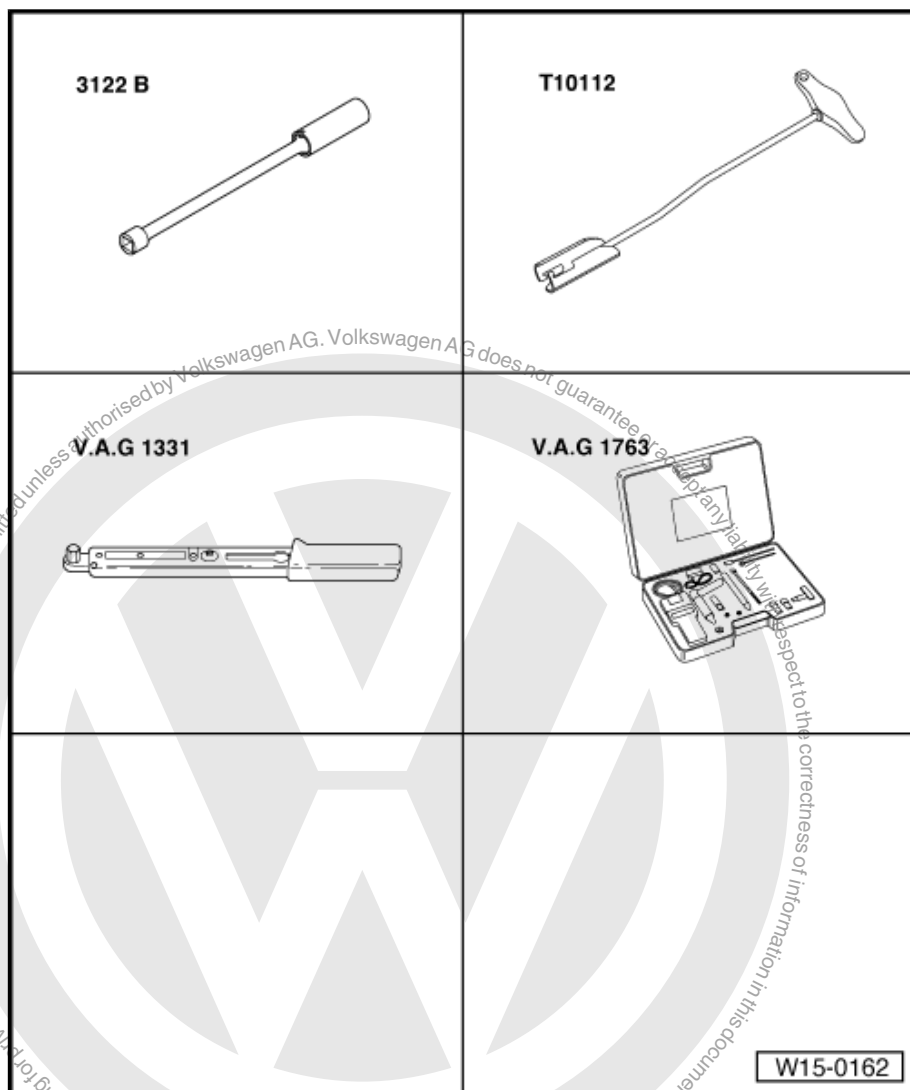


- ◆ Valve Lever - VW541/1A-
- ◆ Valve Lever - Press Tool 5 - VW541/5-
- ◆ Pressure Hose - VW653/3-

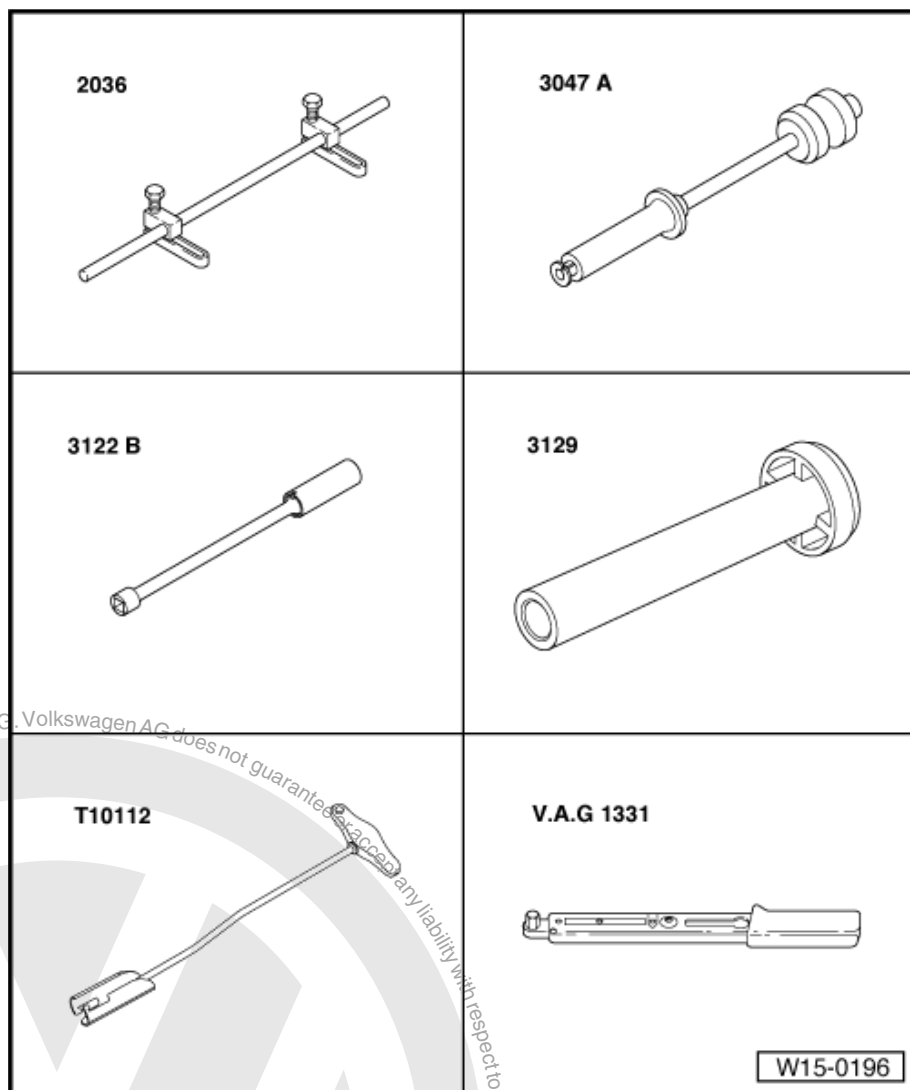


2085 	3415 
T10071 	V.A.G 1331 
V.A.G 1332 	W15-0135

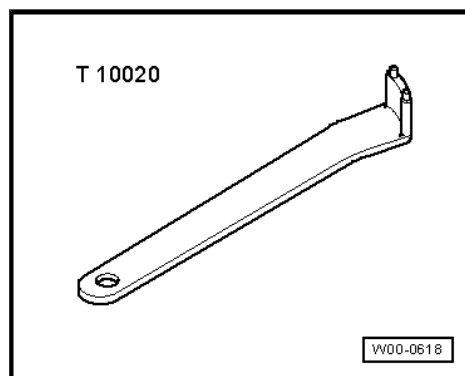
- ◆ Puller - Camshaft Seal - 2085-
- ◆ Counterhold - Crankshaft Sprocket - 3415-
- ◆ Seal Installer - Camshaft - T10071-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Torque Wrench 1332 40-200Nm - VAG1332-



- ◆ Spark Plug Removal Tool - 3122B-
 - ◆ Puller - Spark Plug Connector - T10112A-
 - ◆ Torque Wrench 1331 5-50Nm - VAG1331-
 - ◆ Compression Tester Kit - VAG1763-
- (with cylinder head installed)

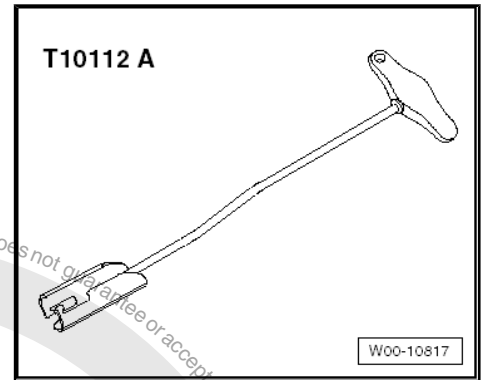


- ◆ Seal Installer - Valve Stem Seal Tool - 2036-
- ◆ Slide Hammer - 3047A-
- ◆ Spark Plug Removal Tool - 3122B-
- ◆ Seal Installer - Valve Stem - 3129-
- ◆ Puller - Spark Plug Connector - T10112A-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Toothed Belt Tensioner - T10020-

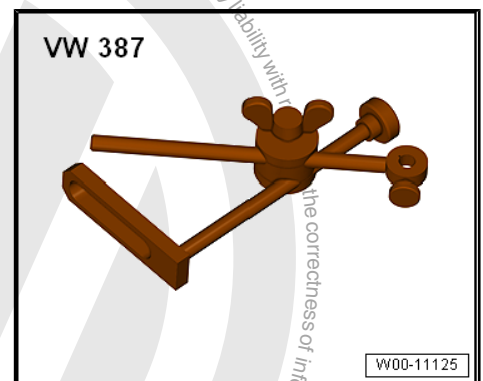




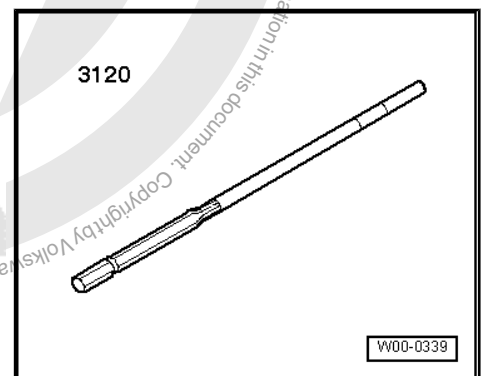
- ◆ Puller - Spark Plug Connector - T10112A-



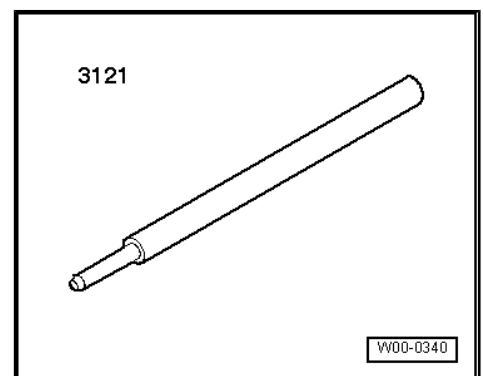
- ◆ Dial Gauge Holder - VW387-



- ◆ Valve Guide Reamer - 7mm - 3120-



- ◆ Valve Guide Drift - 3121-



17 – Lubrication

1 Oil Pan/Oil Pump

⇒ [“1.1 Overview - Oil Pan/Oil Pump”, page 86](#)

⇒ [“1.2 Engine Oil”, page 87](#)

⇒ [“1.3 Oil Pan, Removing and Installing”, page 88](#)

⇒ [“1.4 Oil Pump, Removing and Installing”, page 91](#)

1.1 Overview - Oil Pan/Oil Pump

1 - Bolt

- ☐ 15 Nm

2 - Sealing Flange on Belt Pulley Side

- ☐ Must be located on dowel sleeves
- ☐ Removing and installing. Refer to
⇒ [“1.4 Sealing Flange, Removing and Installing, Belt Pulley Side”, page 34](#)

3 - Relief Valve

- ☐ 27 Nm
- ☐ Opening pressure: 1.3 to 1.6 bar (18.85 to 23.2 psi) pressure

4 - Oil Spray Jet

5 - Oil Dipstick

- ☐ Oil level must not be above the max. mark!
- ☐ Marks. Refer to
⇒ [Fig. “Oil Dipstick Markings”, page 88](#)

6 - Funnel

- ☐ Attached to the intake manifold
- ☐ For extracting oil

7 - Guide Tube

8 - Alignment Sleeves

9 - O-ring

- ☐ Replace after removing

10 - Bolt

- ☐ 15 Nm

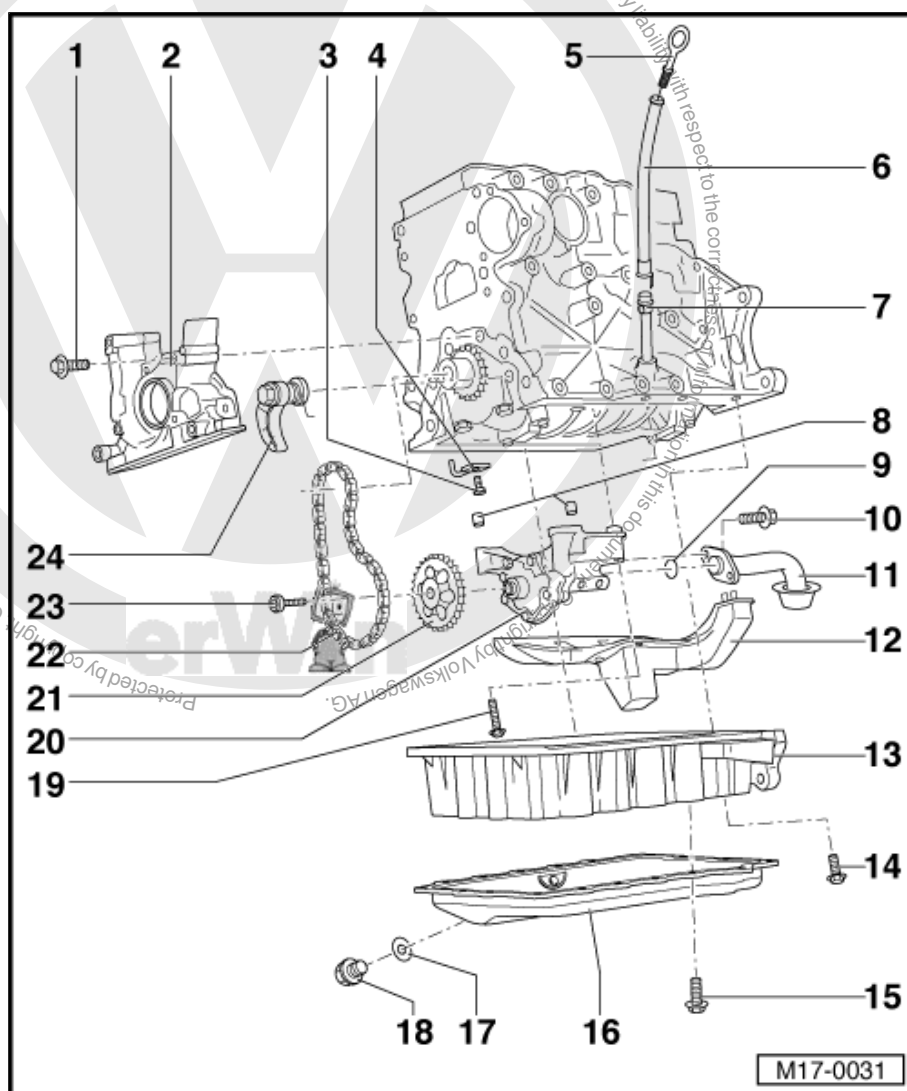
11 - Intake Line

- ☐ Clean the screen if it is dirty.

12 - Splash Wall

13 - Oil Pan Upper Section

- ☐ Clean sealing surface before installing





- ☐ Removing and installing. Refer to ⇒ ["1.3 Oil Pan, Removing and Installing", page 88](#) .

14 - Bolt

- ☐ 15 Nm

15 - Bolt

- ☐ 22 Nm

16 - Oil Pan Lower Section

- ☐ Removing and installing. Refer to ⇒ [page 90](#) .

17 - Seal

- ☐ Cannot be lost on the oil drain bolt

18 - Oil Drain Plug

- ☐ 30 Nm
- ☐ Replace after removing

19 - Bolt

- ☐ 10 Nm

20 - Oil Pump

- ☐ With pressure relief valve 12 bar (174 psi)
- ☐ Replace if running surfaces and gears are scored
- ☐ Removing and installing. Refer to ⇒ ["1.4 Oil Pump, Removing and Installing", page 91](#) .

21 - Chain Sprocket for Oil Pump

- ☐ Note the installation position

22 - Chain

23 - Bolt

- ☐ 20 Nm +90°
- ☐ Replace after removing

24 - Chain Tensioner with Tensioning Rail

- ☐ 15 Nm
- ☐ When installing, pretension spring and hook in

1.2 Engine Oil



Note

- ◆ *The oil level must not go above the MAX mark - danger of causing damage to the catalytic converter!*
- ◆ *If large quantities of metal shavings or abraded material are detected during engine repairs, it may mean the crankshaft or connecting rod bearings are damaged. To prevent subsequent damage, the following work must be performed after the repair:*
- ◆ *Clean the oil channels carefully.*
- ◆ *Replace the oil spray jets.*
- ◆ *Replace the engine oil cooler.*
- ◆ *Replace the oil filter.*

Oil Capacities

Refer to ⇒ Fluid Capacity Tables; Rep. Gr. 03



If necessary, fill to MAX marking on the oil dipstick. Refer to
⇒ [Fig. "Oil Dipstick Markings"](#), [page 88](#) .

Viscosity Classes and Oil Specifications

Refer to ⇒ Maintenance ; Booklet "Maintenance Tables"

Oil Dipstick Markings

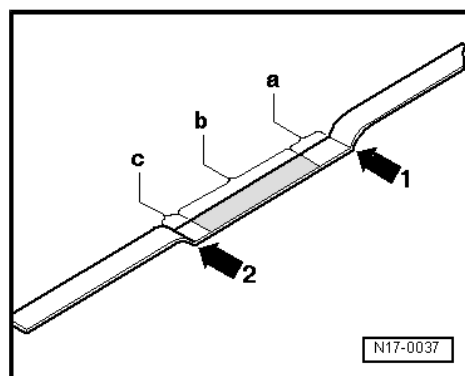
1 - MAX marking

2 - MIN marking

a - Area above the hatched field up to the MAX mark: Do not add oil!

b - Oil level in the hatched areas: engine oil can be filled.

c - From the MIN marking up to the hatched field: add maximum 0.5 liters (0.52 quart) oil!



1.3 Oil Pan, Removing and Installing

Special tools and workshop equipment required

- ◆ T Bar And Socket - 10mm - 3185-
- ◆ Hex Ball Socket - T10058-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Hand Drill With Plastic Brush Attachment
- ◆ For the correct sealant. Refer to the Parts Catalog.



Note

- ◆ *The oil pan consists of 2 sections (upper section and lower section) The complete oil pan is removed from the cylinder block.*
- ◆ *Install the oil pan lower section only if only the oil pan lower section was removed. Refer to ⇒ [page 90](#) .*

Removing

- Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation
- Drain the engine oil.



Note

Observe disposal regulations!

- Remove the oil pan bolts.



Note

Loosen the oil pan bolts on the flywheel side using the -3185- and remove with the -T10058- .

- Remove oil pan, if necessary loosen by applying light strikes with a rubber hammer.
- Remove any sealant residue on the cylinder block using a flat blade scraper.



WARNING

To prevent injuries, wear protective eyewear and protective clothing.

- Remove the sealant residue on the oil pan using a rotating brush such as a hand drill with a plastic brush attachment.
- Sealing surfaces must be free of oil and grease.

Installing



Note

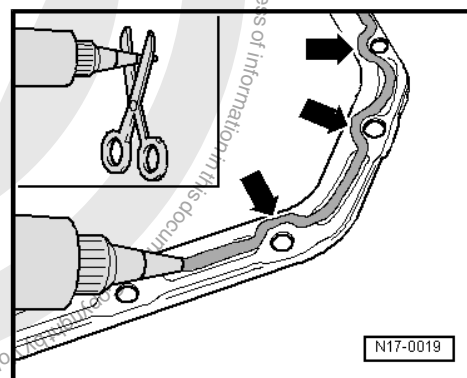
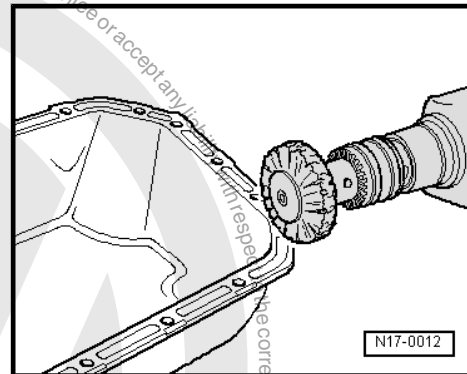
- ◆ Be sure to check the expiration date of the sealant.
- ◆ The oil pan must be installed within 5 minutes of being applied with sealant.

- Cut the tube nozzle at the front marking (nozzle diameter: Approximately 1 mm).
- Apply Sealant on the cleaned sealing surface on the oil pan as illustrated.
- The sealant bead must be 1 to 2 mm thick.
- And run on inside of bolt holes -arrows-



Note

The sealant bead must not be thicker. The extra sealant will get into the oil pan and can clog up the intake line for the oil pump.



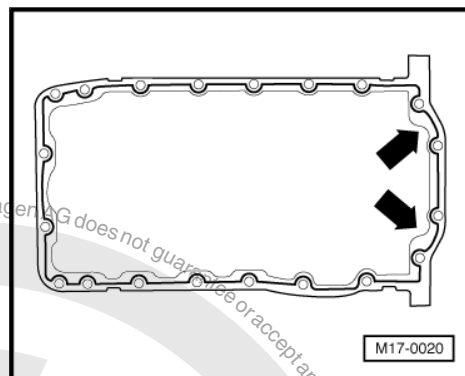


- Be especially careful when applying the bead of sealant near -arrows-.



Note

- ◆ *When installing the oil pan to a removed engine, make sure that the oil pan is positioned flush with the cylinder block on the flywheel side.*
- ◆ *After installing the oil pan, allow the sealant to dry for approximately 30 minutes. Only after then may the engine oil be replenished.*



- Mount the oil pan immediately and tighten the bolts as follows:

- 1 - Tighten all bolts of oil pan/cylinder block only very lightly in diagonal sequence.
- 2 - Lightly tighten bolts of oil pan/transmission.
- 3 - Lightly tighten the oil pan/cylinder block bolts further in a diagonal sequence.
- 4 - Tighten the oil pan/transmission bolts.
- 5 - Tighten all oil pan/cylinder block bolts in a diagonal sequence.

Step	Bolts	Tightening Specifications and Sequence
1.	Oil pan/Cylinder block	Tighten very lightly in a diagonal sequence
2.	Oil pan/Transmission	Tighten lightly
3.	Oil pan/Cylinder block	Retighten lightly in a diagonal sequence
4.	Oil pan/Transmission	45 Nm
5.	Oil pan/Cylinder block	15 Nm

If the Oil Pan Lower Section was Removed:



WARNING

To prevent injuries, wear protective eyewear and protective clothing.

- Remove the sealant residue on the oil pan upper and lower sections using a rotating brush such as a hand drill with a plastic brush attachment.
- Clean the sealing surfaces.
- Sealing surfaces must be completely free of oil and grease.



Note

- ◆ *Be sure to check the expiration date of the sealant.*
- ◆ *The oil pan (lower part) must be installed within 5 minutes after application of sealant.*



- Apply Sealant to the clean sealing surfaces on the oil pan lower section as shown.
- The sealant bead -A- must be 1 to 2 mm thick.
- and run on inside of bolt holes -arrows-

Note

The sealant bead must not be thicker. The extra sealant will get into the oil pan and can clog the intake line for the oil pump.

- Install the oil pan lower section immediately and tighten the bolts as follows:
- 1 - Tighten all the bolts slightly.
- 2 - Tighten all bolts in a diagonal sequence.

Tightening Specifications

Component	Tightening Specifications
Oil pan lower section bolts	22 Nm

Assemble in reverse order of disassembly.

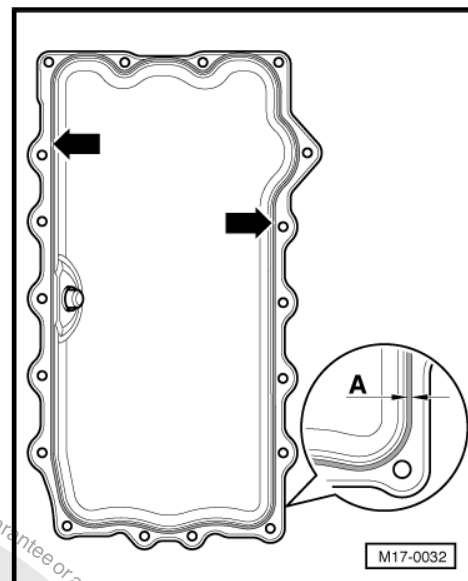
1.4 Oil Pump, Removing and Installing

Note

- ◆ *The oil level must not go above the MAX mark - danger of causing damage to the catalytic converter!*
- ◆ *If large quantities of metal shavings or abraded material are detected during engine repairs, it may mean the crankshaft or connecting rod bearings are damaged. To prevent subsequent damage, the following work must be performed after the repair:*
- ◆ *Clean the oil channels carefully.*
- ◆ *Replace the oil spray jets.*
- ◆ *Replace the engine oil cooler.*
- ◆ *Replace the oil filter.*

Removing

- Remove the oil pan. Refer to ["1.3 Oil Pan, Removing and Installing", page 88](#).
- Remove the splash wall.
- Remove the bolt -2-.
- Remove the chain sprocket from the oil pump shaft.





- Remove the bolts -1 and 3- and the oil pump.

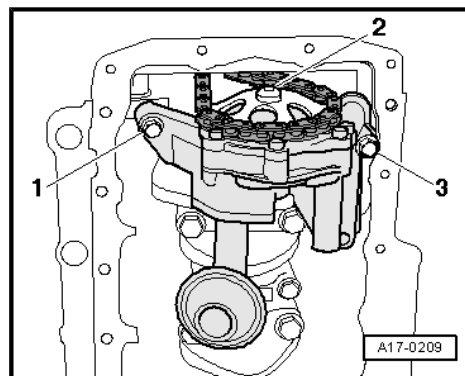
Installing

Install in reverse order of removal. Pay attention to the following:

- Mount the alignment sleeves on the upper part of the oil pump.

The chain sprocket can only be installed in one position.

- Replace the chain sprocket bolt.
- Install the splash wall.
- Install the oil pan. Refer to
⇒ [“1.3 Oil Pan, Removing and Installing”, page 88](#) .



Tightening Specifications

- ◆ Refer to ⇒ [“1.1 Overview - Oil Pan/Oil Pump”, page 86](#)





2 Oil Filter/Oil Pressure Switch

⇒ [“2.1 Oil Pressure and Oil Pressure Switch, Checking”, page 93](#)

⇒ [“2.2 Oil Filter Housing, Removing and Installing”, page 94](#)

2.1 Oil Pressure and Oil Pressure Switch, Checking

Special tools and workshop equipment required

- ◆ Oil Pressure Gauge Kit - VAG1342-
- ◆ Voltage Tester - VAG1527B-
- ◆ Connector Test Set - VAG1594D-

Test Conditions

- Engine oil level OK
- Engine oil temperature at least 80 °C (176 °F) (coolant fan must start up once).



Note

For checking the function and servicing the optical and acoustic oil pressure display. Refer to ⇒ Wiring diagrams, Troubleshooting & Component locations and use the Vehicle Diagnostic Tester in “Guided Fault Finding”; “Function and Component Selection”.





Perform the Following Work

- Remove the Oil Pressure Switch - F1- and install it in the tester.
- Thread oil pressure gauge into oil filter bracket in place of oil pressure switch.
- Connect brown wire on the tester to the ground (-).
- Connect the -VAS6839- to battery positive (+) and the oil pressure switch using adapter cables from the - VAG1594D- .
- LED must not light up.

If the LED lights up:

- Replace the 1.4 bar (20.30 psi) Oil Pressure Switch - F1- .

If the LED does not light up:

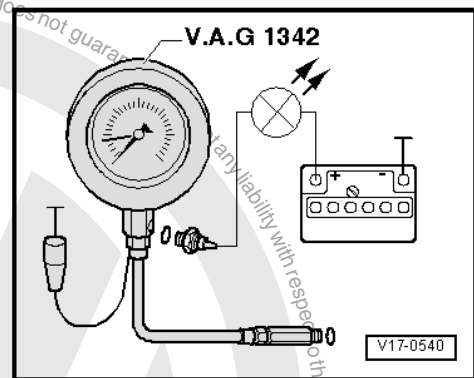
- Start the engine and increase the RPM.
- The LED must light up at 1.2 to 1.6 bar (17.4 to 23.2 psi) pressure. If it does not, replace the oil pressure switch.
- Increase engine speed further.
- At 2,000 RPM and an oil temperature of 80 °C (176 °F), the oil pressure must be 2.7 to 4.5 bar (39.16 to 65.26 psi).
- At higher engine speeds oil pressure must not exceed 7.0 bar (101.52 psi)

If the specified values are not obtained:

- Correct mechanical damage, for example bearing damage
- Replace oil filter bracket with pressure valve, or oil pump.

If the specification is exceeded:

- Check the oil passages.
- If necessary, replace oil filter bracket together with pressure relief valve.



2.2 Oil Filter Housing, Removing and Installing



1 - Sealing Plug

- ☐ 40 Nm
- ☐ Replace after removing
- ☐ With seal

2 - Spring

- ☐ For pressure relief valve, approximately 4 bar (58 psi)

3 - Piston

- ☐ For pressure relief valve, approximately 4 bar (58 psi)

4 - Seal

- ☐ Replace after removing

5 - Check Valve

- ☐ 8 Nm
- ☐ Installed in the oil filter bracket
- ☐ Not available as a replacement part

6 - Sealing Plug

- ☐ 15 Nm

7 - Seal

- ☐ Permanent on the plug
- ☐ If sealing ring is leaking cut open and replace.

8 - Oil Pressure Switch - F1-

- ☐ 25 Nm
- ☐ Black
- ☐ Checking. Refer to [⇒ "2.1 Oil Pressure and Oil Pressure Switch, Checking", page 93](#) .
- ☐ 1.4 bar (20.30 psi)

9 - Seal

- ☐ Permanently on the Oil Pressure Switch - F1-
- ☐ If sealing ring is leaking cut open and replace.

10 - Oil Filter Bracket

11 - Screw

- ☐ 15 Nm +90°
- ☐ Replace after removing

12 - Seal

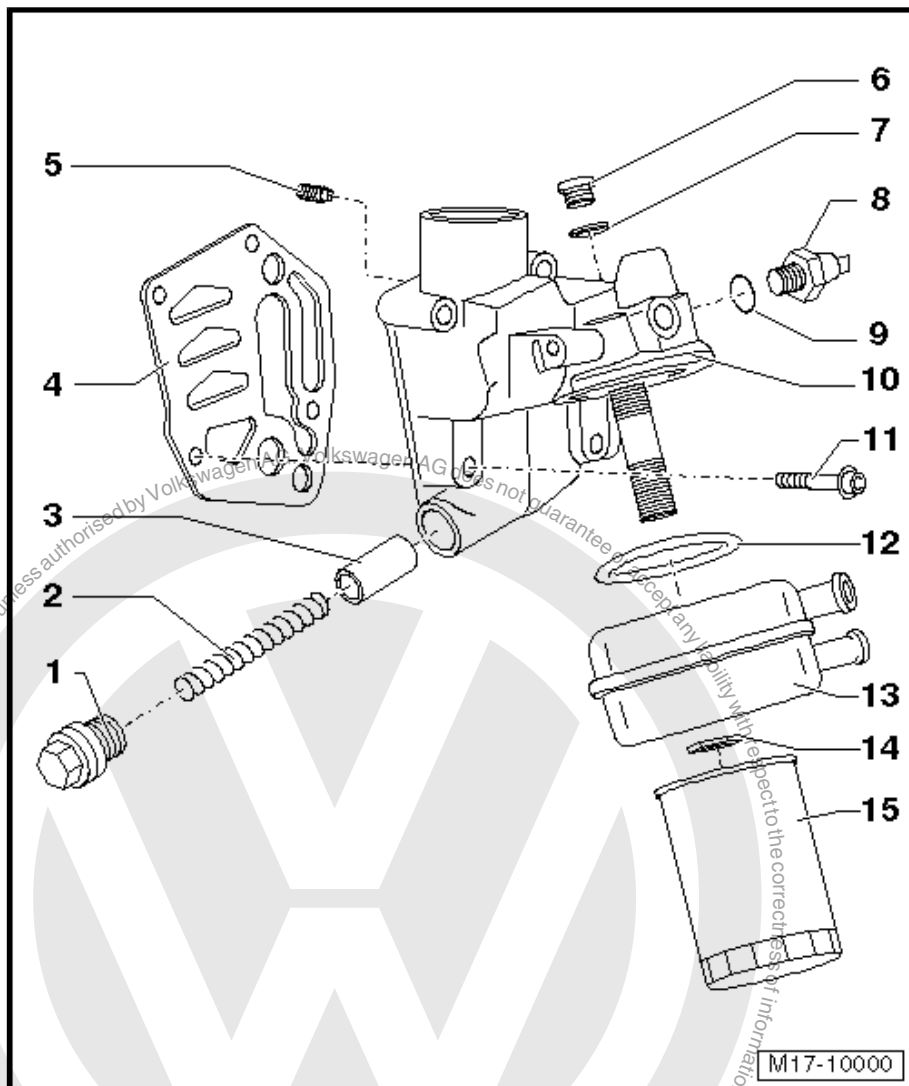
- ☐ Replace after removing
- ☐ Snaps into the tabs on the oil cooler

13 - Engine Oil Cooler

- ☐ Coat the contact surfaces to the oil filter bracket outside of the seal with Sealant
- ☐ Make sure there is enough space to the surrounding components
- ☐ See note. Refer to [⇒ "1 Oil Pan/Oil Pump", page 86](#) .

14 - Screw

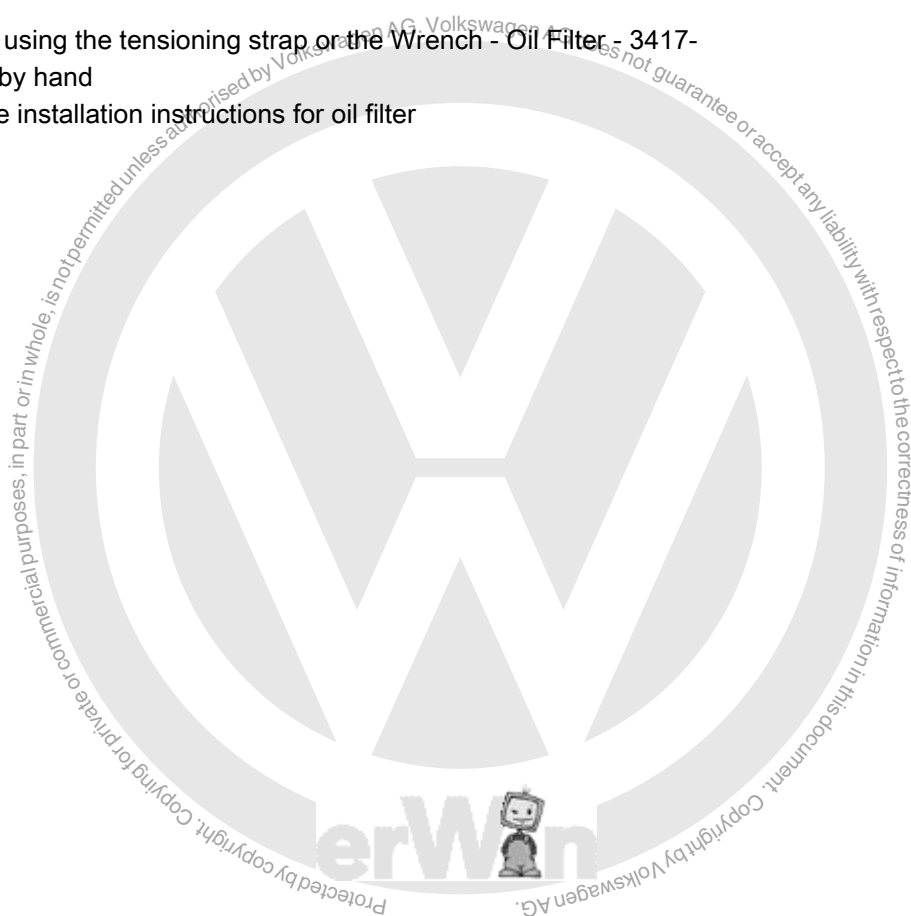
- ☐ 25 Nm





15 - Oil Filter

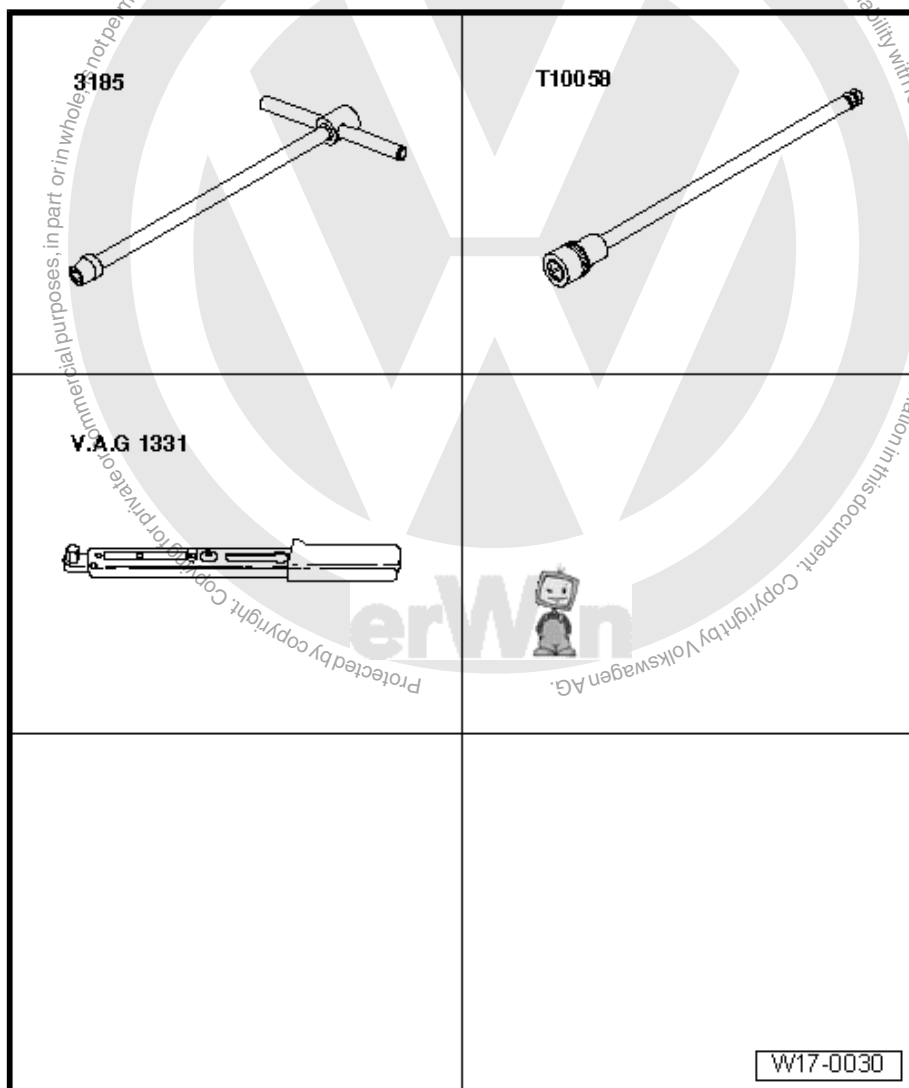
- ☐ Loosen using the tensioning strap or the Wrench - Oil Filter - 3417-
- ☐ Fasten by hand
- ☐ Observe installation instructions for oil filter



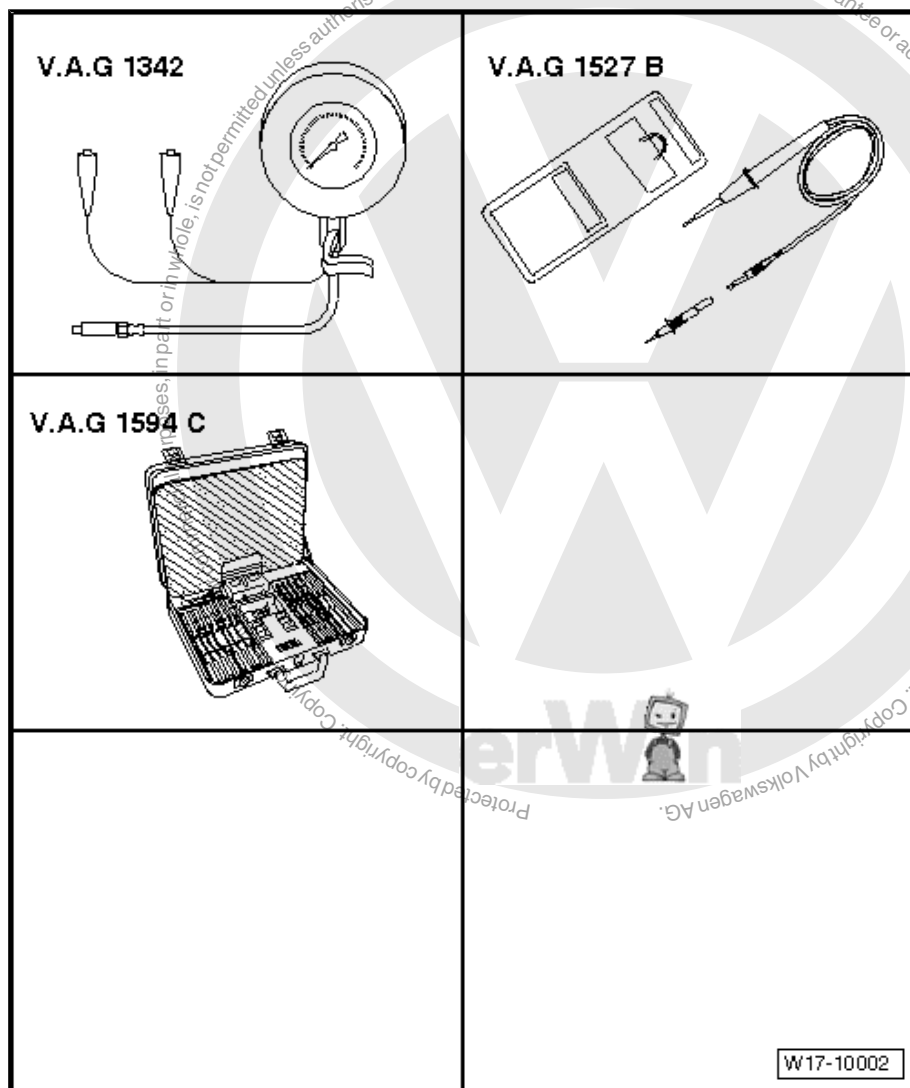


3 Special Tools

Special tools and workshop equipment required



- ◆ T Bar And Socket - 10mm - 3185-
- ◆ Hex Ball Socket - T10058-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Hand Drill With Plastic Brush Attachment
- ◆ For the correct sealant. Refer to the Parts Catalog.



- ◆ Oil Pressure Gauge Kit - VAG1342-
- ◆ Voltage Tester - VAG1527B-
- ◆ Connector Test Set - VAG1594D-



19 – Cooling System

1 Coolant System/Coolant

⇒ [“1.1 Connection Diagram - Coolant Hoses”, page 99](#)

⇒ [“1.2 Overview - Engine Pre-Warmer”, page 100](#)

⇒ [“1.3 Coolant System, Checking for Leaks”, page 100](#)

⇒ [“1.4 Coolant, Draining and Filling”, page 101](#)

1.1 Connection Diagram - Coolant Hoses

1 - Reservoir

- ☐ With cap
- ☐ Pressure relief valve inside cap, checking. Refer to
 ⇒ [“1.3 Coolant System, Checking for Leaks”, page 100](#)

2 - Intake Manifold

3 - Throttle Valve Control Module - J338

4 - Coolant Distribution Housing

5 - Heater Core

- ☐ Replace the coolant after replacing the heater core.

6 - Coolant Pipe

7 - Bypass Thermostat

- ☐ Only for vehicles with an automatic transmission
- ☐ Overview. Refer to
 ⇒ [Fig. “Overview - Bypass Thermostat”, page 108](#)
- ☐ Checking. Refer to
 ⇒ [page 108](#)

8 - Transmission Fluid Cooler

- ☐ Only for vehicles with an automatic transmission

9 - Coolant Hose Connections at the top of the Radiator

10 - Coolant Hose Connection at the bottom of the Radiator

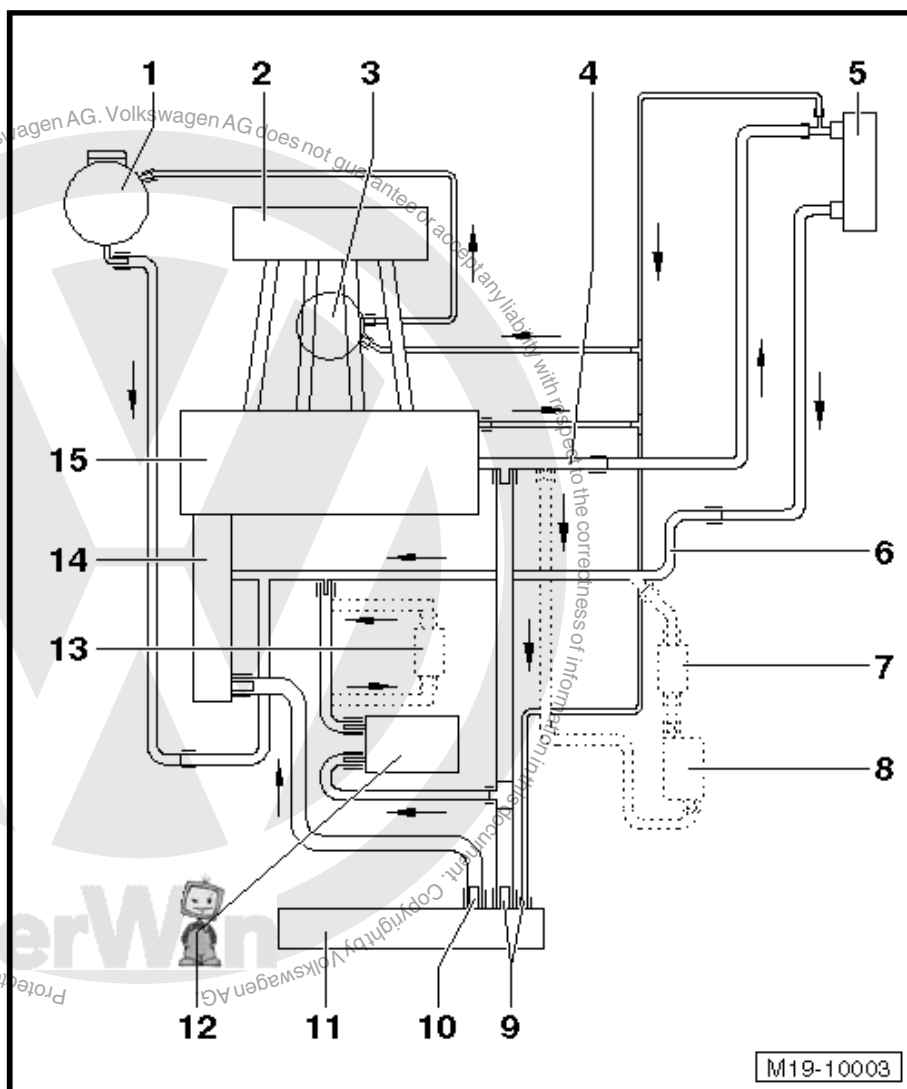
11 - Radiator

- ☐ Replace the coolant after replacing the heater core.
- ☐ Removing and installing. Refer to ⇒ [“3.2 Radiator, Removing and Installing”, page 113](#)

12 - Engine Oil Cooler

13 - Preheater

- ☐ Only on vehicles with an engine preheater





14 - Coolant Pump and Coolant Thermostat

- ☐ Coolant pump, removing and installing. Refer to ➔ ["2.2 Coolant Pump, Removing and Installing", page 108](#) .
- ☐ Coolant thermostat, removing and installing. Refer to ➔ ["2.3 Coolant Thermostat, Removing and Installing", page 109](#) .
- ☐ Checking coolant regulator. Refer to -item 22- ➔ [Item 22 \(page 107\)](#) .

15 - Cylinder Head/Cylinder Block

- ☐ Replace the coolant after replacing the heater core.

12 Overview - Engine Pre-Warmer

Not all vehicles have a pre-heater.

1 Left Cover

- ☐ Inside the front bumper cover

2 - Mount

3 - Connecting Cable

- ☐ Make sure it is attached securely

4 - Locking Mechanism

5 - Preheater

6 - From the Oil Cooler

- ☐ -Item 19- ➔ [Item 19 \(page 107\)](#)

7 - To the Coolant Pipe

- ☐ -Item 9- ➔ [Item 9 \(page 106\)](#)

8 - Adhesive Foil

- ☐ Attached on the pre-heater near screw-type clamp to prevent corrosion on the contacts

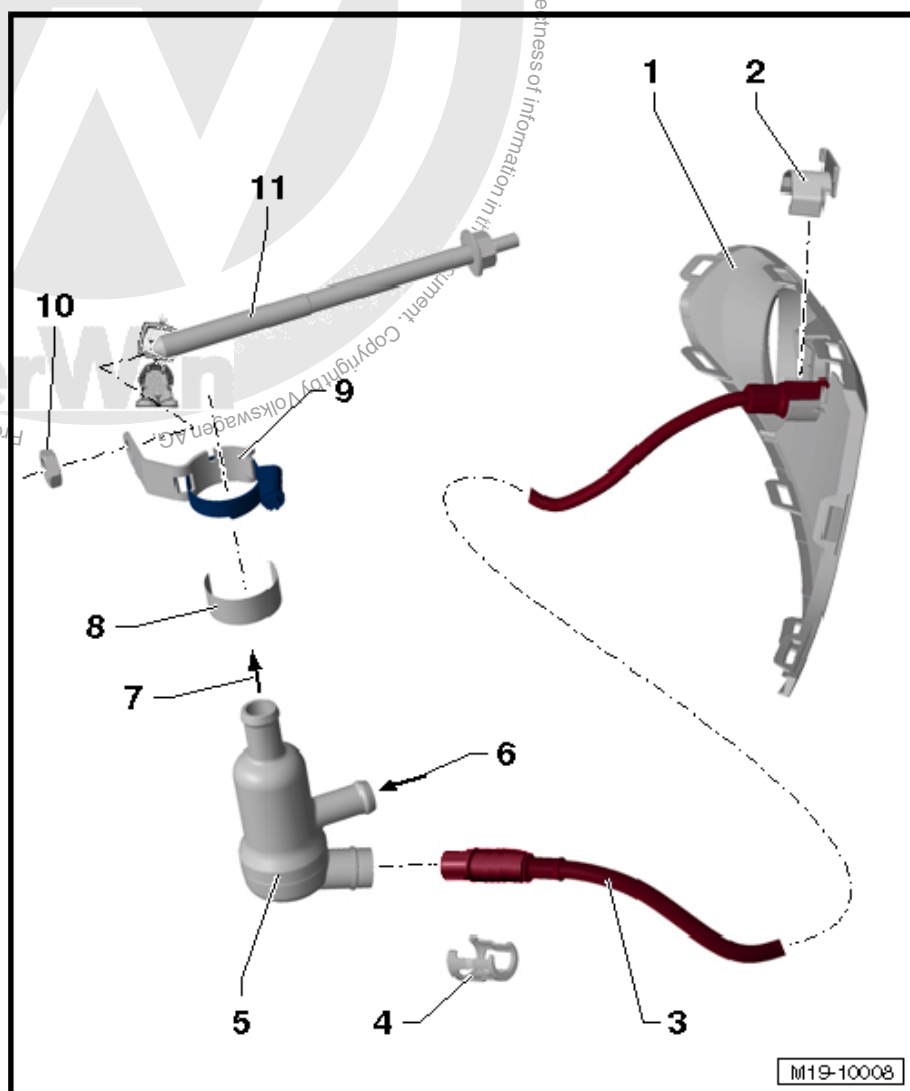
9 - Bracket with Screw-Type Clamp

- ☐ Tighten the screw-type clamp to 3 Nm.

10 - Bolt

- ☐ 40 Nm

11 - Starter Bolt



1.3 Coolant System, Checking for Leaks

Special tools and workshop equipment required

- ◆ Cooling System Tester - VAG1274B-
- ◆ Cooling System Tester - Adapter - VAG1274/8-
- ◆ Cooling System Tester - Adapter - VAG1274/9-



Test Conditions

- Engine at operating temperature.

Perform the Following Work



WARNING

Risk of scalding due to hot steam and hot coolant.

- ◆ **The coolant system is under pressure when the engine is warm.**
- ◆ **Wear protective goggles and protective clothing to prevent damage to eyes and scalding.**
- ◆ **Reduce pressure by covering coolant expansion tank cap with a cloth and carefully opening.**

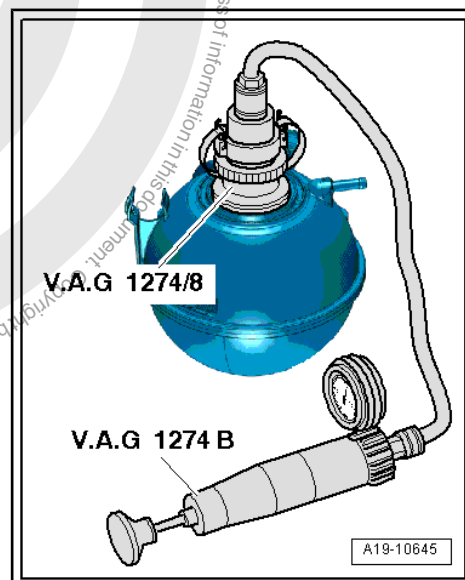
- Open the reservoir.
- Install the -VAG1274/8- in the coolant expansion tank.
- Clamp the Cooling System Tester Connecting Piece - VAG1274B/1- in the -VAG1274/8- .
- Connect the -VAG1274B/1- to the -VAG1274B- using the hose provided.
- Generate a positive pressure of approximately 1.0 bar (14.5 psi) using hand pump of cooling system tester.



WARNING

Risk of scalding!

- ◆ **Before disconnecting the -VAG1274B- from the connecting hose or -VAG1274B/1- , the existing pressure must always be reduced.**
- ◆ **To do this, press the pressure release valve on the -VAG1274B- until the pressure gauge displays »0«.**



If the pressure drops:

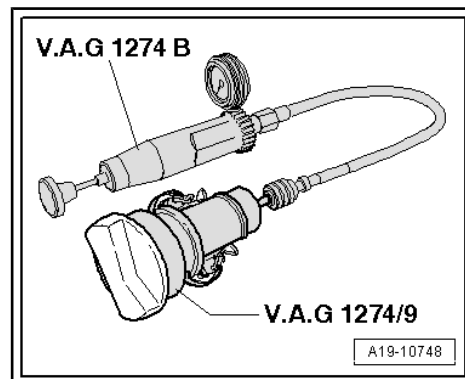
- Search for leaking areas and repair the malfunction.

Pressure Relief Valve in Cap, Checking

- Install the cap in the -VAG1274/9- .
- Clamp the -VAG1274B/1- in the -VAG1274/9- .
- Connect the -VAG1274B/1- to the -VAG1274B- using the hose provided.
- Actuate the hand pump.
- The pressure release valve must open at 1.4 to 1.6 bar (20.30 to 23.20 psi).

If the pressure relief valve opens too early or too late:

- Replace the cover.



1.4 Coolant, Draining and Filling

Special tools and workshop equipment required

- ◆ Cooling System Tester - Adapter - VAG1274/8-



- ◆ Instrument/Gauge Tester - VAG1306- or Shop Crane - Drip Tray - VAS6208-
- ◆ Hose Clip Pliers
- ◆ Cooling System Charge Kit - VAS6096-
- ◆ Refractometer - T10007A-



WARNING

Risk of scalding due to hot steam and hot coolant.

- ◆ ***The coolant system is under pressure when the engine is warm.***
- ◆ ***Wear protective goggles and protective clothing to prevent damage to eyes and scalding.***
- ◆ ***Reduce pressure by covering coolant expansion tank cap with a cloth and carefully opening.***



Note

- ◆ *When the engine is warm the cooling system is under pressure. If necessary release pressure before commencing repair work.*
- ◆ *Secure all hose connections with hose clamps. For the correct allocation. Refer to the Parts Catalog.*
- ◆ *Pliers For Spring-Type Clamps are recommended for installing spring clamps.*
- ◆ *Replace the gaskets and seals.*
- ◆ *Arrows on coolant pipes and coolant hoses must line up across from each other.*

Perform the Following Work

Draining



Note

- ◆ *Drained coolant must be stored in a clean container for disposal or reuse.*
- ◆ *Follow all disposal regulations.*



WARNING

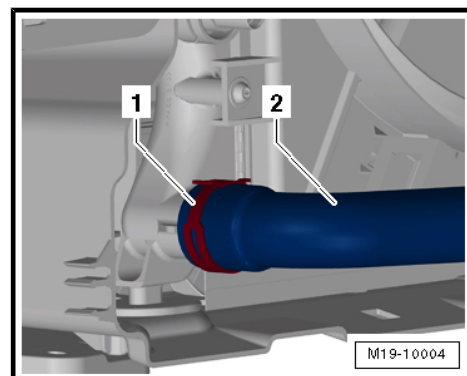
Risk of scalding due to hot steam and hot coolant.

- ◆ ***The coolant system is under pressure when the engine is warm.***
- ◆ ***Wear protective goggles and protective clothing to prevent damage to eyes and scalding.***
- ◆ ***Reduce pressure by covering coolant expansion tank cap with a cloth and carefully opening.***

- Open the cap on the reservoir.



- Remove the noise insulation. Refer to ➤ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .
- Place the -VAS6208- under the radiator.
- Open the spring clamp -1- and remove the coolant hose -2-.



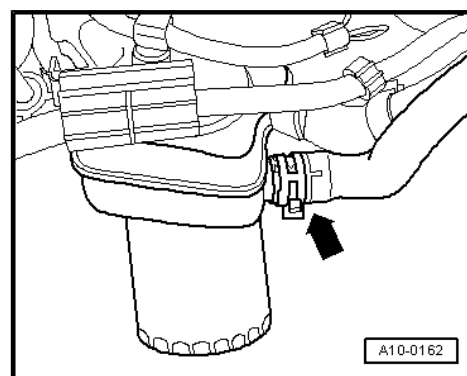
- Remove the coolant hose -arrow- on the engine oil cooler.

Filling



Note

- ◆ *The water portion of the coolant influences the effectiveness of the coolant.*
- ◆ *Volkswagen has decided to define the water quality used in the cooling system based on the different mixtures and country and regional requirements.*
- ◆ *Use distilled water.*
- ◆ *For this reason, we recommend using distilled water for older models when adding coolant or filling coolant for the first time.*



Caution

Only use distilled water for mixing with G12 Plusplus. Using distilled water provides optimum corrosion protection.

**Note**

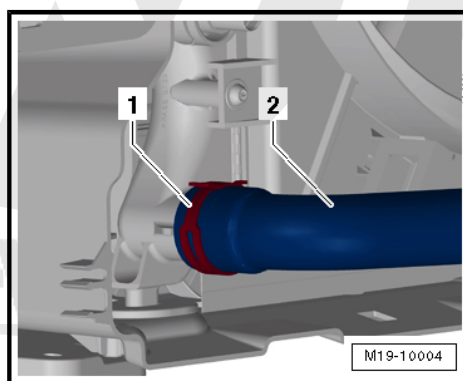
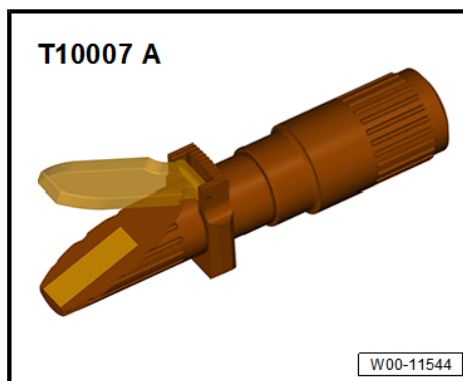
- ◆ Only use coolant additive G 12 Plus Plus that conforms to TL VW 774 G.
- ◆ Coolant additives with the note "conforming to TL VW 774 G" prevent frost, corrosion damage and scaling. The boiling point will be raised. For this reason the system must be filled all year round with frost and corrosion protection additives.
- ◆ Because of its high boiling point, the coolant contributes to engine reliability under heavy loads, particularly in countries with tropical climates.
- ◆ Freeze protection must be assured to about -25 °C (-13 °F) (in arctic climatic countries to about -35 °C (-31 °F)).
- ◆ The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The coolant additive portion must be at least 40%.
- ◆ If a lower freeze protection is necessary due to the climatic conditions, increase the amount of coolant additive. Increase the coolant additive only up to 60% (freeze protection raised to approximately -40 °C (-40 °F)). Otherwise the freeze protection and cooling effect are reduced.
- ◆ The - T10007A- is recommended for determining the current freeze protection density.
- ◆ Do not use the old coolant again if replacing the radiator, heater core, cylinder head or cylinder head gasket.

Recommended Mixture Ratios

Frost Protection to	Freeze Protection Portion	G 12 Plus-plus ¹⁾	Distilled Water ¹⁾
-25 °C (-13 °F)	40 %	2.0L	3.0L
-35 °C (-31 °F)	50 %	2.5L	2.5L

¹⁾ The quantity of coolant can vary depending upon the vehicle equipment.

- Connect the coolant hose -2- to the radiator and secure it with a spring clamp -1-.





- Install the coolant hose -arrow- on the engine oil cooler and secure it with spring clamp.

Filling with -VAS6096-

- Install the -VAG1274/8- on the expansion tank.
- Fill the coolant circuit using the -VAS6096-. Refer to the -VAS6096- Operating Instructions.

Filling without -VAS6096-

- Slowly add coolant until it reaches the upper marking -arrow- on the reservoir.
- Close the reservoir.
- Turn off the heater and A/C.
- Start the engine and maintain an engine speed of approximately 2000 RPM for about 3 minutes.
- Let engine run until fan starts up.

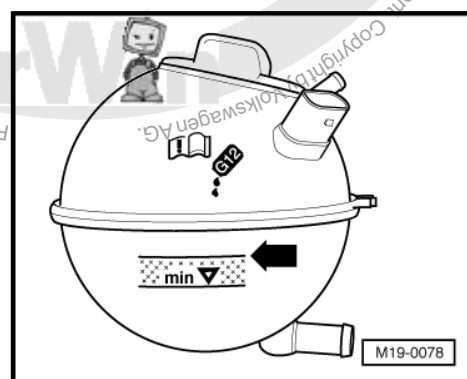
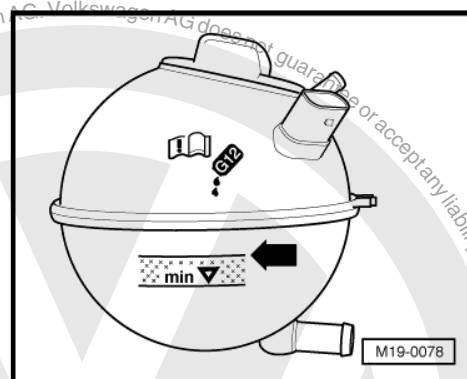
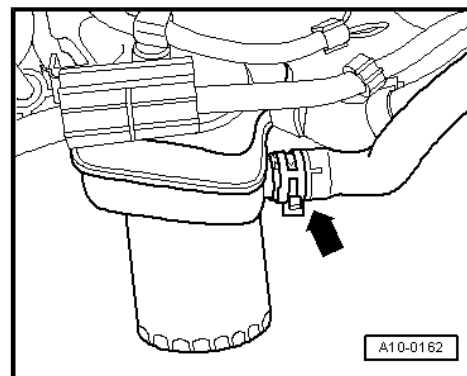


WARNING

Risk of scalding due to hot steam and hot coolant.

- ◆ ***The coolant system is under pressure when the engine is warm.***
- ◆ ***Wear protective goggles and protective clothing to prevent damage to eyes and scalding.***
- ◆ ***Reduce pressure by covering coolant expansion tank cap with a cloth and carefully opening.***

- Check the coolant level with the reservoir closed. If more coolant is needed, let the engine cool down and then add.
- At engine operating temperature, the coolant level must be at the upper marking in the shaded area -arrow-.
- When the engine is cold, the coolant level should be in the middle of the shaded area.





2 Coolant Pump/Thermostat

⇒ [“2.1 Overview - Coolant Pump/Thermostat”, page 106](#)

⇒ [“2.2 Coolant Pump, Removing and Installing”, page 108](#)

⇒ [“2.3 Coolant Thermostat, Removing and Installing”, page 109](#)

2.1 Overview - Coolant Pump/Thermostat



Note

- ◆ *Coolant hose connection diagram. Refer to ⇒ [“1.1 Connection Diagram - Coolant Hoses”, page 99](#).*
- ◆ *Vehicles with an automatic transmission have a by-pass thermostat in the coolant supply hose to the transmission fluid cooler.*

Bypass thermostat - overview. Refer to

⇒ [Fig. “Overview - Bypass Thermostat”, page 108](#).

Bypass thermostat, checking. Refer to ⇒ [page 108](#)

1 - To the Top of Coolant Expansion Tank

2 - Coolant Connections on Heater Core

3 - O-ring

- ☐ Replace after removing

4 - Connector

- ☐ For Engine Coolant Temperature Sensor - G62-
- ☐ 2-pin

5 - Engine Coolant Temperature Sensor - G62-

6 - Clip

- ☐ Make sure it is secure

7 - From Transmission Oil Cooler

- ☐ Only vehicles with automatic transmission

8 - Bolt

- ☐ 40 Nm

9 - Coolant Pipe

10 - Bolt

- ☐ 9 Nm

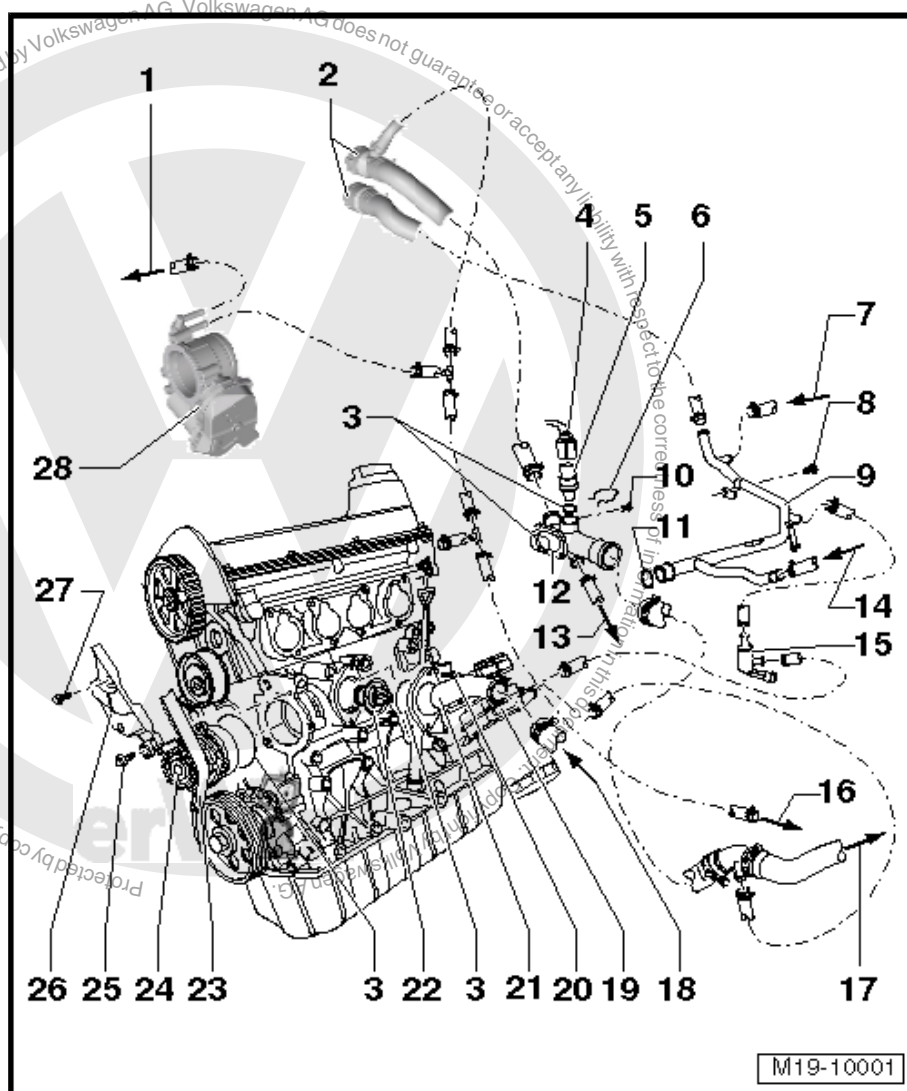
11 - O-ring

- ☐ Replace after removing

12 - Coolant Distribution Housing

13 - To the Transmission Fluid Cooler

- ☐ Only vehicles with automatic transmission





14 - From the Bottom of Reservoir

15 - Preheater

- ☐ Not installed on all vehicles
- ☐ Overview. Refer to ⇒ [“1.2 Overview - Engine Pre-Warmer”, page 100](#) .

16 - To the Upper Radiator Connection

17 - To the Upper Radiator Connection

18 - From the Lower Radiator Connection

19 - Engine Oil Cooler

20 - Bolt

- ☐ 15 Nm

21 - Connection

22 - Coolant Thermostat

- ☐ Checking: warm the thermostat in water
Starts to open: approximately 86 °C (186.8 °F)
Opening lift: minimum 7 mm
- ☐ Removing and installing. Refer to ⇒ [“2.3 Coolant Thermostat, Removing and Installing”, page 109](#) .

23 - Toothed Belt

- ☐ Mark direction of travel before removing
- ☐ Check for wear
- ☐ Do not kink
- ☐ Removing and installing. Refer to ⇒ [“2.2 Toothed Belt, Removing and Installing”, page 59](#) .

24 - Coolant Pump

- ☐ Check for ease of movement
- ☐ Replace completely if damaged or leaking
- ☐ Removing and installing. Refer to ⇒ [“2.2 Coolant Pump, Removing and Installing”, page 108](#) .

25 - Bolt

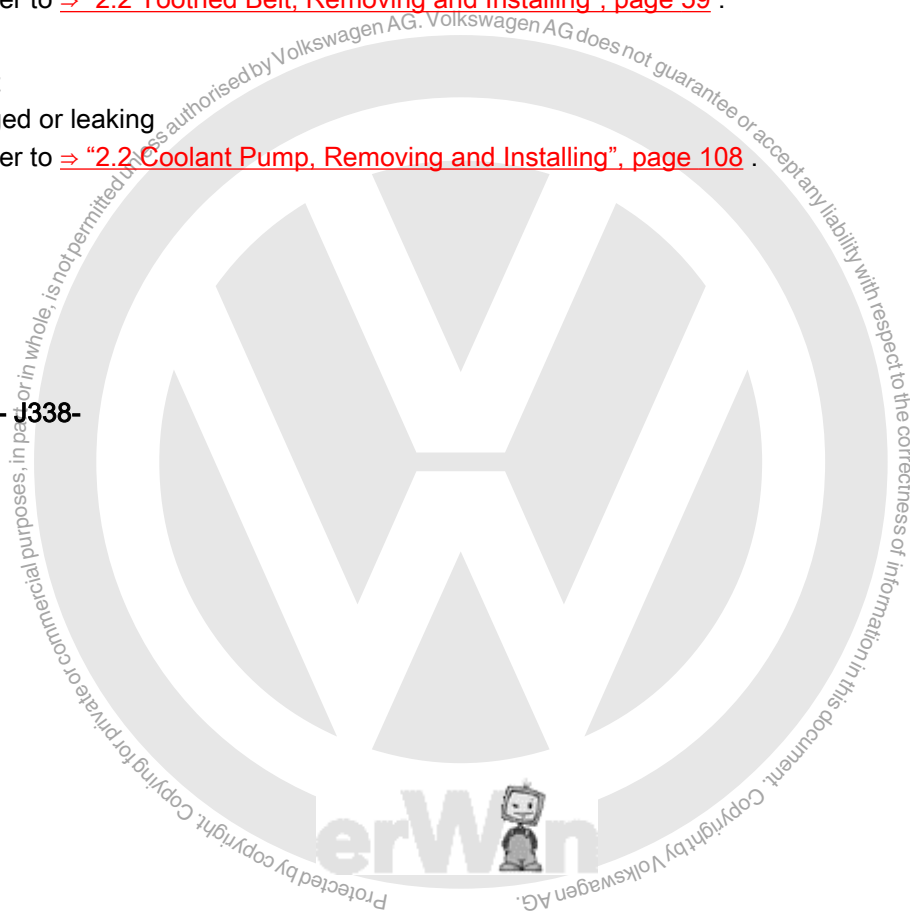
- ☐ 15 Nm

26 - Rear Toothed Belt Guard

27 - Bolt

- ☐ 20 Nm

28 - Throttle Valve Control Module - J338-





Overview - Bypass Thermostat

1 - Spring Bracket

2 - Housing Lower Section

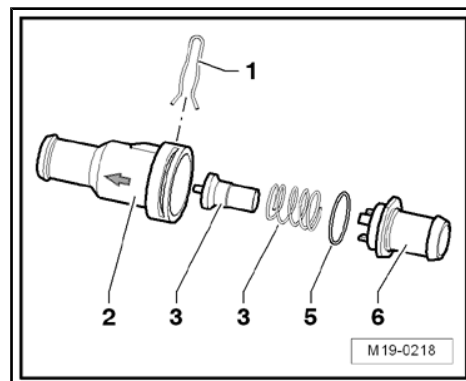
- Pay attention to the installed position: the arrow points to the ATF cooler

3 - Operating Element

4 - Spring

5 - O-ring

6 - Housing Upper Section



Checking Bypass Thermostat

- Remove the operating element -3- and warm it up in hot water.

Opening begins: approximately 75 °C (167 °F)

Opening ends: approximately 85 °C (185 °F)

Opening travel: approximately 5 mm

2.2 Coolant Pump, Removing and Installing

Special tools and workshop equipment required

- ♦ Drip Tray - VAG1306- or Shop Crane - Drip Tray - VAS6208-
- ♦ Torque Wrench 1331 5-50Nm - VAG1331-
- ♦ Hose Clip Pliers

Removing



Note

- ♦ *Replace the gaskets and seals.*
 - ♦ *The lower toothed belt guard can remain installed.*
 - ♦ *The toothed belt remains in position on the crankshaft sprocket.*
 - ♦ *Cover the toothed belt with a cloth to protect it from coolant before removing the coolant pump.*
- Drain the coolant. Refer to
⇒ [“1.4 Coolant, Draining and Filling”, page 101](#) .
 - Remove the ribbed belt. Refer to
⇒ [“1.2 Ribbed Belt, Removing and Installing”, page 31](#) .
 - Remove the ribbed belt tensioning damper.
 - Remove the upper and center toothed belt guards.
 - Remove toothed belt from coolant pump toothed belt sprocket.
Refer to
⇒ [“2.2 Toothed Belt, Removing and Installing”, page 59](#) .

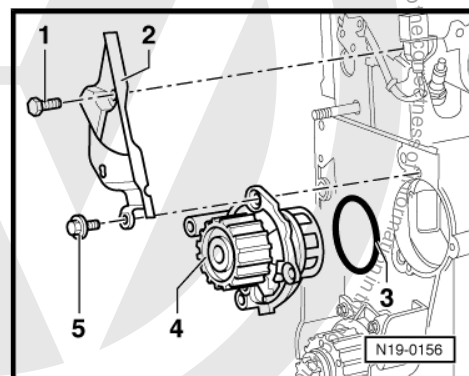
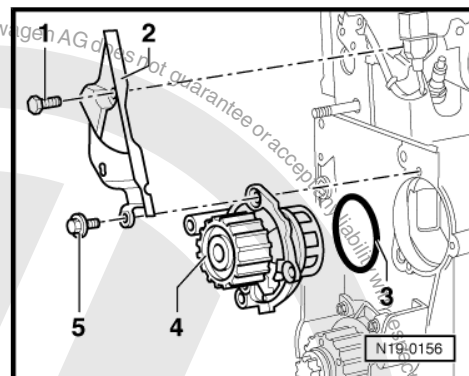


- Remove the bolt -1- from the rear toothed belt guard -2-.
- Remove the bolts -5- for the coolant pump and then remove the coolant pump -4-.

Installing

Install in reverse order of removal. Pay attention to the following:

- Coat the new O-ring -3- with coolant.
- Insert the coolant pump -4-.
- Installed position: Sealing plug in housing points downward.
- Tighten the bolts -5-.
- Install the bolt -1- for the rear toothed belt guard -2- on the cylinder head.
- Install the toothed belt. Refer to
 ⇒ [“2.2 Toothed Belt, Removing and Installing”, page 59](#) .
- Install the ribbed belt tensioning element.
- Install the ribbed belt. Refer to
 ⇒ [“1.2 Ribbed Belt, Removing and Installing”, page 31](#) .
- Fill with coolant. Refer to
 ⇒ [“1.4 Coolant, Draining and Filling”, page 101](#) .



Tightening Specifications

- ◆ Refer to
 ⇒ [“2.1 Overview - Coolant Pump/Thermostat”, page 106](#)
- ◆ Refer to
 ⇒ [“1.1 Overview - Cylinder Block, Belt Pulley Side”, page 30](#)

2.3 Coolant Thermostat, Removing and Installing

Special tools and workshop equipment required

- ◆ Hose Clip Pliers
- ◆ Drip Tray - VAG1306- or Shop Crane - Drip Tray - VAS6208-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Hose Clip Pliers

Perform the Following Work

Removing

- Drain the coolant. Refer to
 ⇒ [“1.4 Coolant, Draining and Filling”, page 101](#) .
- Place the -VAS6208- under the engine.



- Remove the coolant hose from the connection -3-.
- Remove the bolts -4- from the connection -3- and the connection -3- with the thermostat -1-.

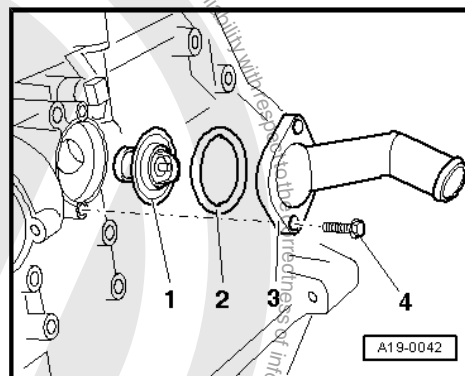
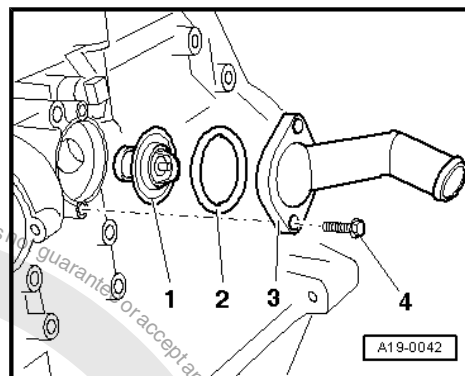
Installing

Install in reverse order of removal. Pay attention to the following:

- Coat the new O-ring -2- with coolant.
- Install the connection -3- and the thermostat -1- in the cylinder block.
- The clip of thermostat must be positioned at approximately right angle.
- Tighten the bolts -4-.
- Fill with coolant. Refer to
⇒ ["1.4 Coolant Draining and Filling", page 101](#).

Tightening Specifications

- ◆ Refer to
⇒ ["2.1 Overview Coolant Pump/Thermostat", page 106](#)





3 Radiator/Coolant Fan

⇒ [“3.1 Overview - Radiator/Coolant Fan”, page 111](#)

⇒ [“3.2 Radiator, Removing and Installing”, page 113](#)

⇒ [“3.3 Coolant Fan V7 and Coolant Fan 2 V177, Removing and Installing”, page 114](#)

3.1 Overview - Radiator/Coolant Fan



Note

- ◆ Spring clamps secure the coolant hoses to the radiator.
- ◆ Coolant hose connection diagram. Refer to ⇒ [“1.1 Connection Diagram - Coolant Hoses”, page 99](#).

1 - Upper Coolant Hose

- From the distribution piece to the cylinder head

2 - Radiator

- Removing and installing. Refer to ⇒ [“3.2 Radiator, Removing and Installing”, page 113](#).
- After replacing, replace entire amount of coolant.

3 - Upper Seal

4 - Cap

- Check using Cooling System Tester - VAG1274B- and Cooling System Tester - Adapter - VAG1274/9-. Refer to ⇒ [“1.3 Coolant System, Checking for Leaks”, page 100](#).

- The pressure release valve must open at a pressure of 1.4 to 1.6 bar (20.30 to 23.20 psi)

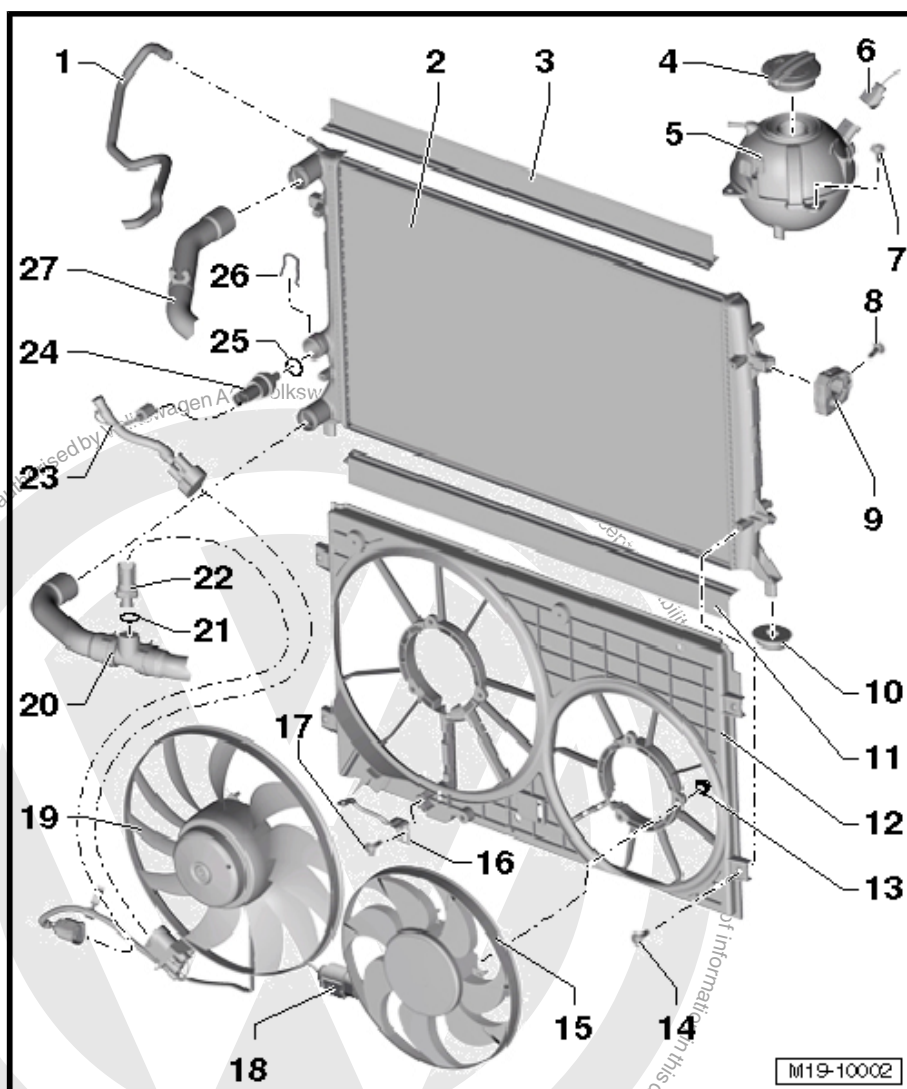
5 - Reservoir

- Perform a leak test for the coolant system using the Cooling System Tester - VAG1274B- and Cooling System Tester - Adapter - VAG1274/8-. Refer to ⇒ [“1.3 Coolant System, Checking for Leaks”, page 100](#).

6 - Connector

7 - Screw

- 2 Nm





8 - Screw

- ☐ 7 Nm

9 - Bearing

- ☐ For the radiator

10 - Mount

- ☐ Insert in lock carrier

11 - Lower Seal

12 - Air Shroud

13 - Screw

- ☐ 5 Nm

14 - Screw

- ☐ 5 Nm

15 - Coolant Fan 2 - V177-

- ☐ Removing and installing. Refer to
⇒ [“3.3 Coolant Fan V7 and Coolant Fan 2 V177 , Removing and Installing”, page 114](#) .

16 Mount

- ☐ For connecting pipe -item 26- ⇒ [Item 26 \(page 128\)](#)

17 - Screw

- ☐ 2 Nm

18 - Connector

19 - Coolant Fan - V7-

- ☐ Removing and installing. Refer to
⇒ [“3.3 Coolant Fan V7 and Coolant Fan 2 V177 , Removing and Installing”, page 114](#) .
- ☐ For vehicles with A/C system with Coolant Fan Control Module - J293-
- ☐ The Coolant Fan Control Module - J293- is integrated in the Coolant Fan - V7- .

20 - Lower Coolant Hose

- ☐ From connection for coolant regulator

21 - O-ring

- ☐ Replace after removing

22 - Coolant Fan Control Thermal Switch - F18-

- ☐ 3 Nm
- ☐ Only for vehicles without A/C system
- ☐ For Coolant Fan - V7-

Switching temperatures, level 1:

- ☐ On: 92 to 97 °C (197.6 to 206.6 °F)
- ☐ Off: 84 to 91 °C (183.2 to 195.8 °F)

Switching temperatures, level 2:

- ☐ On: 99 to 105 °C (210.2 to 221 °F)
- ☐ Off: 91 to 98 °C (195.8 to 208.4 °F)

23 - Wiring Harness

- ☐ For Engine Coolant Temperature Sensor on Radiator Outlet - G83-
- ☐ For the coolant fan
- ☐ For the Coolant Fan Control Thermal Switch - F18- (vehicles without A/C system)

24 - Engine Coolant Temperature Sensor on Radiator Outlet - G83-

25 - O-ring

- ☐ Replace after removing



26 - Clip

- ☐ Make sure it is secure

27 - Upper Coolant Hose

- ☐ From the coolant distribution housing to the cylinder head

3.2 Radiator, Removing and Installing

Special tools and workshop equipment required

- ◆ Drip Tray - VAG1306- or Shop Crane - Drip Tray - VAS6208-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Hose Clip Pliers

Removing

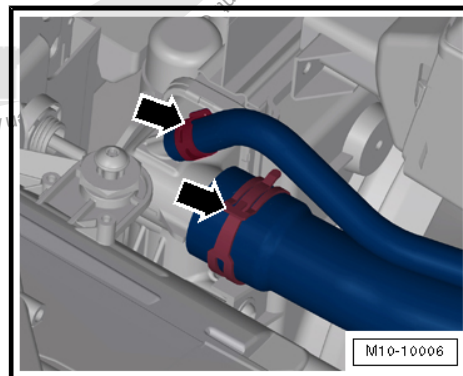
- Remove the air shroud with the radiator fans. Refer to [⇒ "3.3 Coolant Fan V7 and Coolant Fan 2 V177, Removing and Installing", page 114](#).
- Drain the coolant. Refer to [⇒ "1.4 Coolant, Draining and Filling", page 101](#).
- Open the spring clamps -arrows- and remove the coolant hoses from the radiator.
- Remove the front bumper cover. Refer to [⇒ Body Exterior; Rep. Gr. 63 ; Front Bumper; Bumper Cover, Removing and Installing](#).

Vehicles with A/C System



Caution

To prevent damage to the condenser and the refrigerant lines, make sure not to stretch, kink or bend the lines.



- Remove the air guides -3- at the bottom.
- Remove the bolts -1- from the condenser.

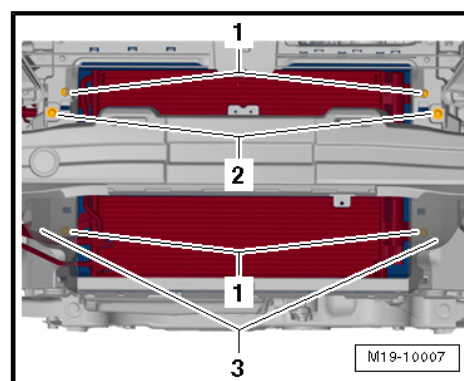
Continuation for All Vehicles

- Remove the bolts -2- from the radiator mounts.
- Push the radiator to the rear and remove the radiator mounts (-item 9- [⇒ Item 9 \(page 112\)](#)).
- Remove the radiator from its mounts in the lock carrier -item 10- [⇒ Item 10 \(page 112\)](#) .

Installing

Install in reverse order of removal. Pay attention to the following:

- Fill the coolant. Refer to [⇒ "1.4 Coolant, Draining and Filling", page 101](#).



Tightening Specifications

Component	Nm
Radiator mounting to lock carrier	7
Condenser to radiator	5
Air intake elbow to cooler	5

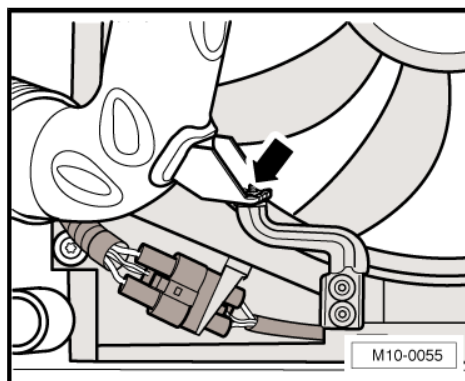


3.3 Coolant Fan - V7- and Coolant Fan 2 - V177- , Removing and Installing

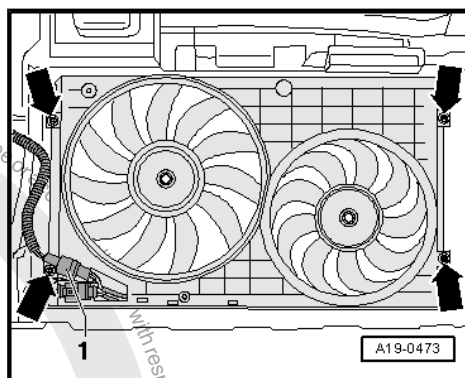
Perform the Following Work

Removing

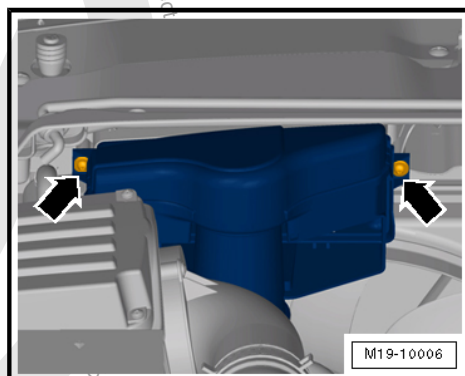
- Remove the noise insulation. Refer to ➤ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .
- Remove the bolt -arrow- from the connecting pipe.



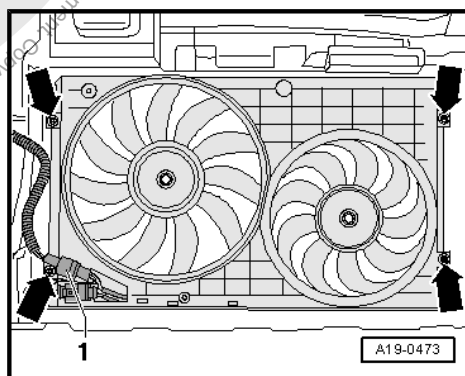
- Disconnect the connector -1-.
- Remove the bolts -arrows- from the bottom of the air shroud.



- Remove the air intake connection from the lock carrier -arrows-.



- Remove the bolts -arrows- from the top of the air shroud.
- Remove the air shroud.
- Disconnect the connector -1- and free up the wiring harness. The installed position of the connector varies from the picture.





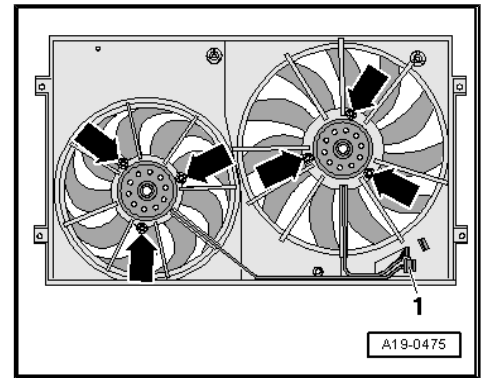
- Remove the nuts -arrows- and the fan.

Installing

Install in reverse order of removal. Pay attention to the following:

Tightening Specifications

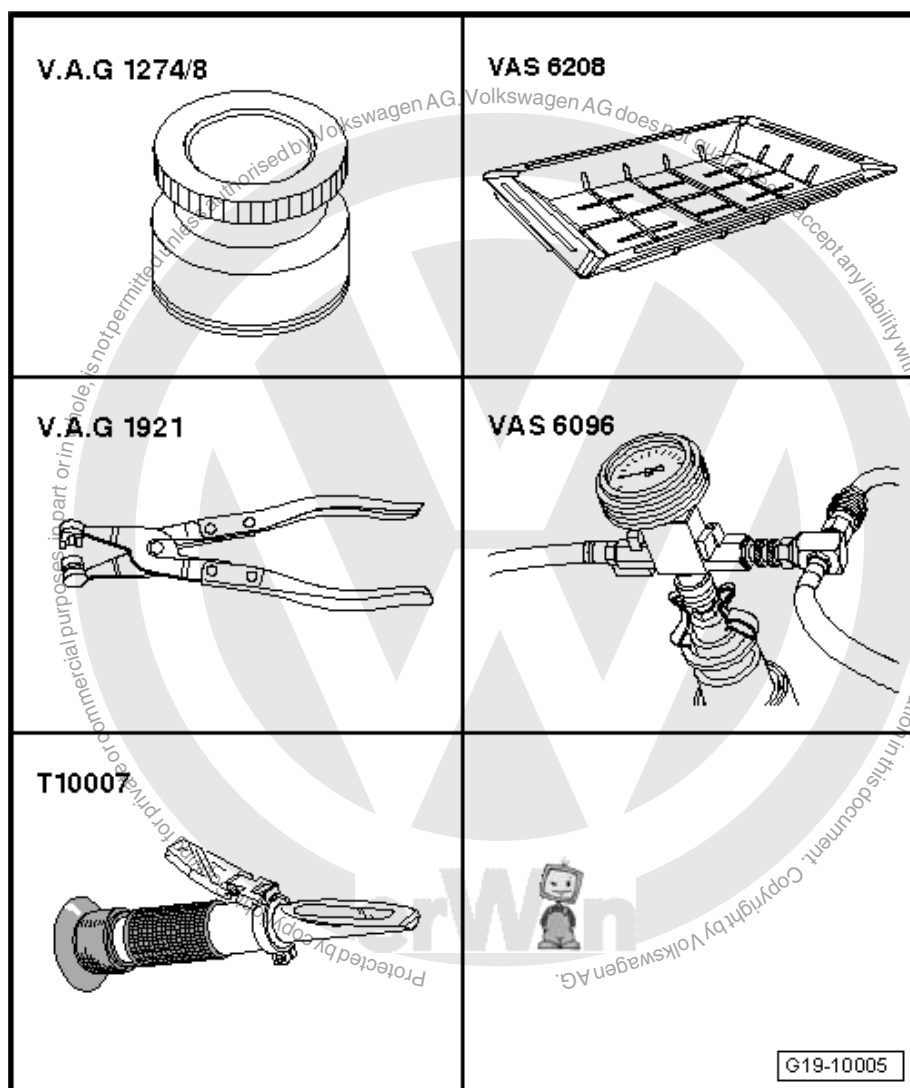
Component	Nm
Coolant fan to intake air elbow	5
Air intake elbow to cooler	5





4 Special Tools

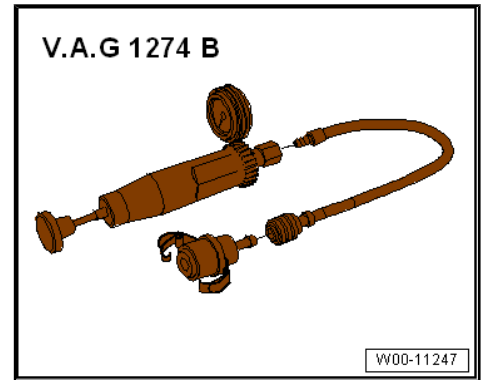
Special tools and workshop equipment required



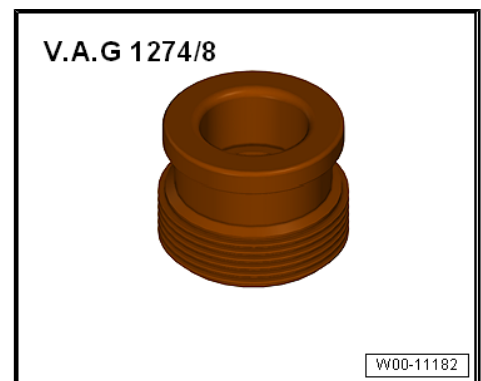
- ◆ Cooling System Tester - Adapter - VAG1274/8-
- ◆ Instrument/Gauge Tester - VAG1306- or Shop Crane - Drip Tray - VAS6208-
- ◆ Hose Clip Pliers
- ◆ Cooling System Charge Kit - VAS6096-
- ◆ Refractometer - T10007A-



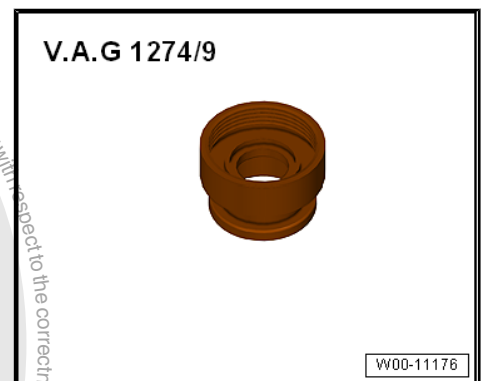
◆ Cooling System Tester - VAG1274B-



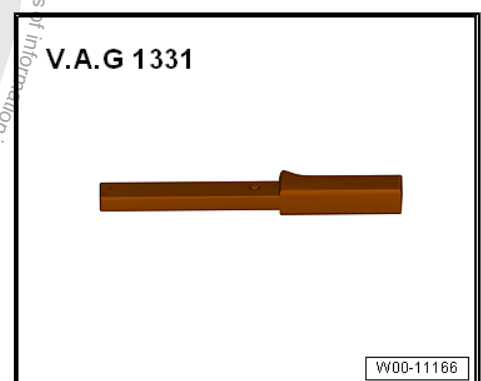
◆ Cooling System Tester - Adapter - VAG1274/8-



◆ Cooling System Tester - Adapter - VAG1274/9-



◆ Torque Wrench 1331 5-50Nm - VAG1331-



24 – Multiport Fuel Injection

1 Fuel Injection System

⇒ [“1.1 Component Location Overview - Fuel Injection System”, page 118](#)

⇒ [“1.2 Fuel System, Filling/Bleeding”, page 119](#)

1.1 Component Location Overview - Fuel Injection System

1 - Heated Oxygen Sensor - G39- Before Catalytic Converter

- ☐ 55 Nm
- ☐ Component location: Inside the exhaust manifold
- ☐ Only grease the threads with Hot Bolt Paste - G 052 118 A3- ; the Hot Bolt Paste - G 052 118 A3- must not enter the slits on the sensor body

2 - Connector

- ☐ 6-pin
- ☐ Contacts gold plated
- ☐ Black
- ☐ For Heated Oxygen Sensor - G39- before catalytic converter and Oxygen Sensor Heater - Z19-
- ☐ Installed location: on the left side of the bulkhead -item 14-
⇒ [Item 14 \(page 119\)](#)

3 - Oxygen Sensor after Three Way Catalytic Converter - G130-

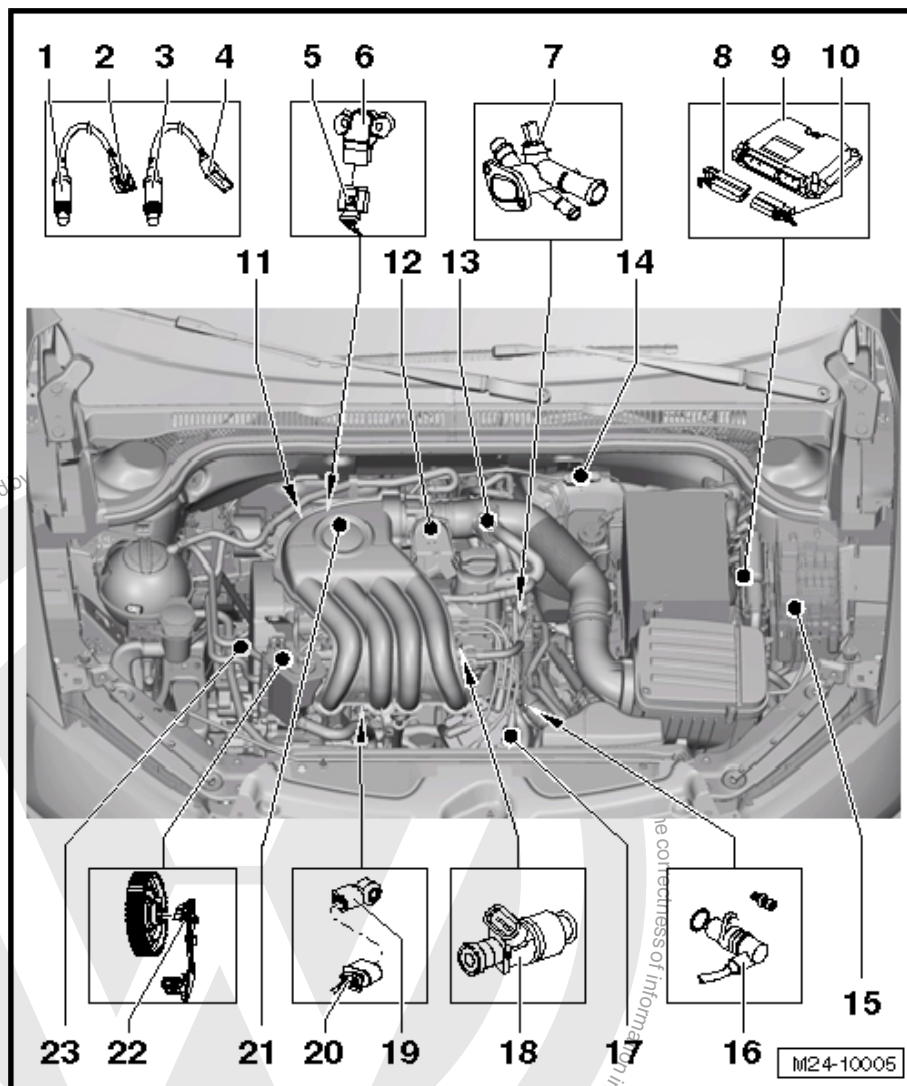
- ☐ 55 Nm
- ☐ Installed location: inside the catalytic converter
- ☐ Only grease the threads with Hot Bolt Paste - G 052 118 A3- ; the Hot Bolt Paste - G 052 118 A3- must not enter the slits on the sensor body

4 - 4-Pin Connector

- ☐ Contacts gold plated
- ☐ Brown
- ☐ For Oxygen Sensor after Three Way Catalytic Converter - G130- and Heater for Oxygen Sensor 1 after Catalytic Converter - Z29-
- ☐ Component location: Under the underbody. Refer to
⇒ [Fig. ““Connector for Oxygen Sensor after Three Way Catalytic Converter -G130-””, page 148](#)

5 - Manifold Absolute Pressure Sensor - G71-

- ☐ With Intake Manifold Temperature Sensor - G72-





6 - 4-Pin Connector

- ☐ For Manifold Absolute Pressure Sensor - G71- with Intake Manifold Temperature Sensor - G72-

7 - Engine Coolant Temperature Sensor - G62-

- ☐ Inside the coolant distribution housing

8 - 81-Pin Connector

- ☐ Disconnect and connect the connector with the ignition turned off.
- ☐ Unlock to disconnect

9 - Motronic Engine Control Module - J220-

- ☐ Installed location: next to the engine compartment E-box on the left side
- ☐ Replacing. Refer to ➔ [“6.1 Engine Control Module, Removing and Installing”, page 136](#) .

10 - 40-Pin Connector

- ☐ Disconnect and connect the connector with the ignition turned off.
- ☐ Unlock to disconnect

11 - EVAP Canister Purge Regulator Valve 1 - N80-

- ☐ Installed position: the arrow points in the flow direction
- ☐ Attached to the intake manifold

12 - Throttle Valve Control Module - J338-

13 - Positive Crankcase Ventilation Heating Element - N79-

14 - Connector for Heated Oxygen Sensor - G39-

15 - Engine Compartment E-box on Left Side

- ☐ Relay and fuse installed locations

16 - Engine Speed Sensor - G28-

- ☐ Inside the cylinder block at the front

17 - Ignition Coil

- ☐ With Ignition Coil 1 - N- and Ignition Coil 2 - N128- with Power Output Stage - N122-

18 - Cylinder 1 through 4 Fuel Injectors - N30, N31, N32 and N33-

- ☐ Removing and installing. Refer to ➔ [“2.2 Fuel Injectors, Removing and Installing”, page 123](#) .

19 - Knock Sensor 1 - G61-

- ☐ Inside the cylinder block at the front

20 - 2-Pin Connector

- ☐ Black

21 - Intake Manifold

- ☐ One part

22 - Camshaft Position Sensor - G40-

- ☐ Attached to the cylinder head on the right side

23 - Fuel Supply Line

1.2 Fuel System, Filling/Bleeding

Special tools and workshop equipment required

- ◆ Injection Rate Comparison Meter Kit - Remote Cable - VAG1348/3A-
- ◆ Injection Rate Comparison Meter Kit - Adapter - VAG1348/3-2-
- ◆ Suction Pump - VAS5226-
- ◆ Fuel Injection Gauge Kit - Fuel Bleeder 20 - VAG1318/20-



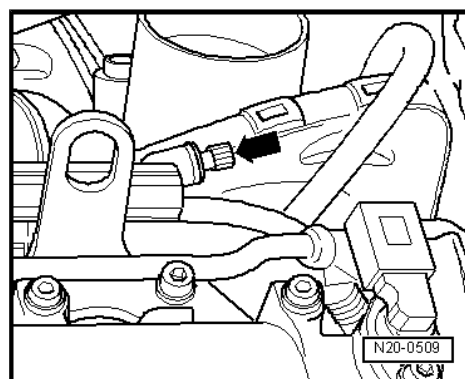
- ◆ Adapter - VAG1318/20-1-
- ◆ The engine control module is equipped with On Board Diagnostics (OBD). Before repairs as well as fault finding, check the DTC memory first. Likewise, the vacuum hoses and connections must be checked (leaks).
- ◆ Fuel hoses in engine compartment must only be secured with spring-type clips. The use of clamp or screw type clips is not permissible.
- ◆ For proper function of the electrical components, a voltage of at least 11.5 V is required.
- ◆ Do not use sealants containing silicone. Particles of silicone drawn into the engine, will not be burnt in the engine and damage the oxygen sensor.
- ◆ The vehicles have a crash fuel shut-off. It reduces the risk of fire in a collision because the fuel pump relay switches the fuel pump off. This setup also makes it easier to start the engine. When the door is opened, the fuel pump is activated for 2 seconds so that pressure builds in the fuel system.

Requirements

- The fuses must be OK.
- The battery voltage must be at least 11.5V.
- The fuel pump relay must be OK.

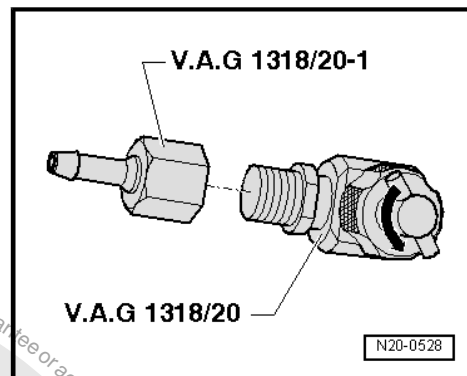
Procedure

- Remove cover in front of fuse holder.
- Pull the fuel pump fuse out of the fuse panel. For the fuse assignment. Refer to ⇒ Wiring diagrams, Troubleshooting & Component locations.
- Connect the -VAG1348/3A- to the bulb socket and battery positive (+) using the -VAG1348/3-2- .
- Remove the air filter housing. Refer to ⇒ ["3.1 Overview - Air Filter Housing", page 127](#) .
- Remove the cap -arrow- from the bleeder valve.

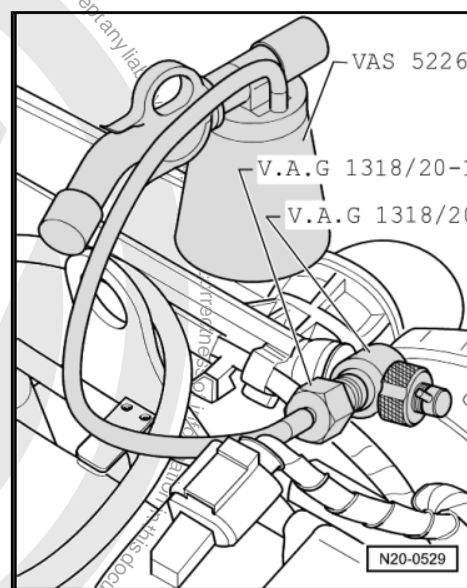




- Attach the -VAG1318/20-1- to the -VAG1318/20- .
- Turn valve (on T-piece) counter-clockwise until it is completely open.



- Install the -VAG1318/20- hand-tight on the bleeder valve.
- Connect the hose from the -VAS5226- as shown.
- Turn valve (on T-piece) clockwise until it stops in the bleeder valve.
- Check the adapter and hose connection for leaks.
- Operate the - VAG1348/3A- until fuel flows free of bubbles out of the bleeder valve.
- Turn valve (on T-piece) counter-clockwise until it is completely open again.
- Clamp off the hose from the -VAS5226- (for example, using the -3094-) and remove it from the -VAG1318/20-1- .
- Remove the -VAG1318/20- from the bleeder valve.





2 Fuel Injectors

⇒ [“2.1 Fuel Rail, Removing and Installing”, page 122](#)

⇒ [“2.2 Fuel Injectors, Removing and Installing”, page 123](#)

⇒ [“2.3 Fuel Injectors, Checking”, page 124](#)

2.1 Fuel Rail, Removing and Installing

Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm - VAG1331-

Perform the Following Work

Removing



Note

- ◆ Follow all safety precautions. Refer to [⇒ “1 Safety Precautions”, page 1](#).
- ◆ Follow the guidelines for clean working conditions. Refer to [⇒ “3.1 Clean Working Conditions”, page 6](#).
- First find out if a encoded radio is installed. If it is, get the anti-theft code.
- Disconnect the battery. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery, Disconnecting and Connecting .

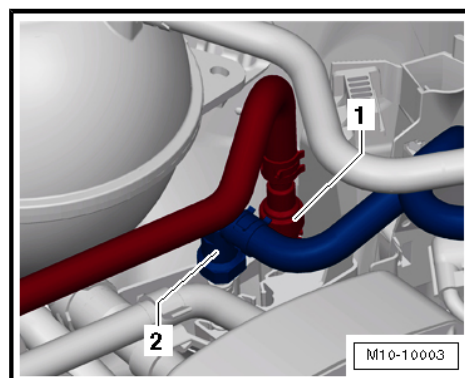


WARNING

Fuel system is under pressure!

- ◆ Wear protective eyewear and protective clothing in order to avoid injury and contact with the skin.
- ◆ Wrap a cloth around the wiring connections before loosening hose connections. Then release pressure by carefully pulling off the line.

- Disconnect the fuel supply line -1-. Push the locking ring upward and into the housing.
- Seal off the line so that dirt cannot get into the fuel system.
- Remove the cable guide from the fuel rail.
- Disconnect the connector -1- for the fuel injectors and the connector -4- for the Camshaft Position Sensor - G40- .
- Remove the bolts -2-.
- Remove the fuel rail -3- and the fuel injectors from the intake manifold.



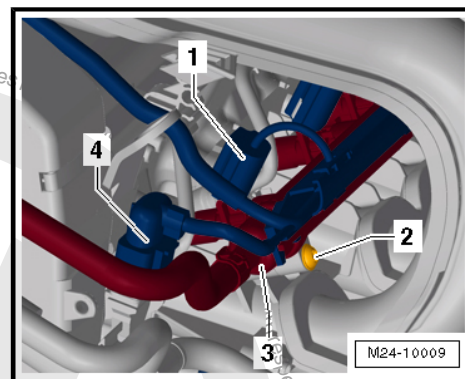


- Seal off or cover the openings in the intake manifold.

Installing

Install in reverse order of removal. Pay attention to the following:

- Replace the seals on all fuel injectors and coat them lightly with clean motor oil.
- Place fuel rail with secured fuel injectors onto intake manifold and apply uniform pressure to press it in.
- Tighten the bolts on the fuel rail.
- Fuel system, bleeding. Refer to
 ⇒ [“1.2 Fuel System, Filling/Bleeding”, page 119](#) .
- Connect the battery. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery, Disconnecting and Connecting .



Tightening Specifications

Component	Tightening Specifications
Fuel rail bolts	9 Nm

2.2 Fuel Injectors, Removing and Installing

Removing



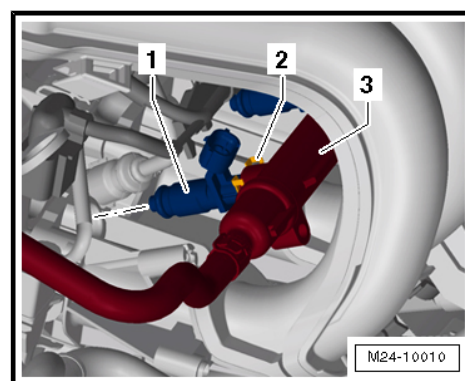
Note

- ♦ Follow all safety precautions. Refer to
 ⇒ [“1 Safety Precautions”, page 1](#) .
- ♦ Follow the guidelines for clean working conditions. Refer to
 ⇒ [“3.1 Clean Working Conditions”, page 6](#) .

- Remove the fuel rail with the fuel injectors. Refer to
 ⇒ [“2.1 Fuel Rail, Removing and Installing”, page 122](#) .
- Remove the retaining clips -2- and the fuel injectors -1- from the fuel rail -3-.

Installing

- Install new O-rings for fuel injectors and coat them lightly with clean engine oil.



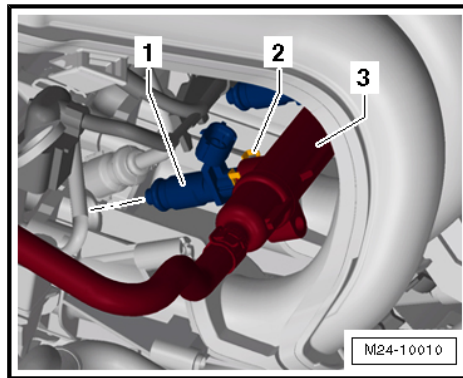


- Insert the fuel injectors -1- into the fuel rail -3- and secure them with the clamps -2-.
- Make sure the fuel injectors are secure after installing them.
- Install the fuel rail with fuel injectors. Refer to ➔ ["2.1 Fuel Rail, Removing and Installing", page 122](#) .



Note

If the fuel injectors were replaced, erase the adaptation values and re-adapt the engine control module using the Vehicle Diagnostic Tester in "Guided Functions".



2.3 Fuel Injectors, Checking

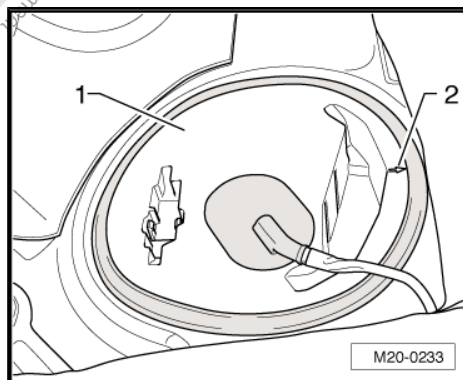
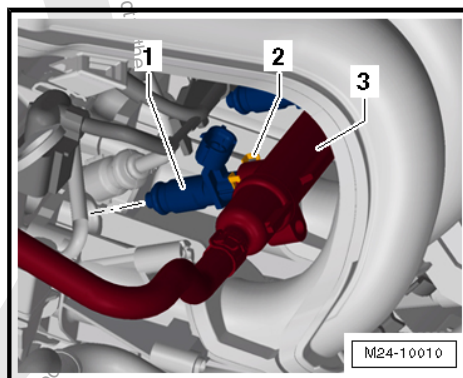
Special tools and workshop equipment required

- ♦ Injection Rate Comparison Meter Kit - Remote Cable - VAG1348/3A-
- ♦ Injection Rate Comparison Meter Kit - Adapter - VAG1348/3-2-
- ♦ Injection Rate Tester - VAG1602-
- ♦ Connector Test Set - VAG1594D-
- ♦ Vehicle Diagnostic Tester - Test Adapter - 5 Pin - VAS5565-

Perform the Following Work

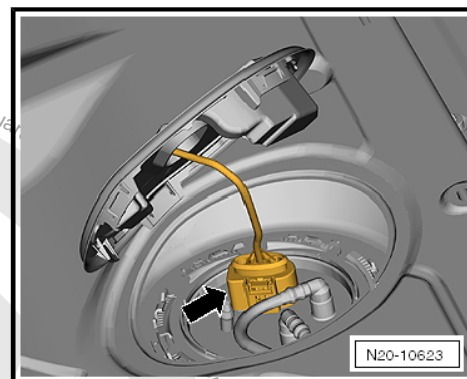
Checking for Leaks

- The fuel pressure must be OK. Refer to ➔ ["5.1 Fuel Pressure Sensor, Checking", page 133](#) .
- Remove the fuel rail -3- with the fuel injectors installed -1- and lay it on a cleaning cloth. Refer to ➔ ["2.1 Fuel Rail, Removing and Installing", page 122](#) .
Do not disconnect battery and do not disconnect fuel supply line at quick acting coupling or at fuel rail.
- The connectors must be disconnected from the fuel injectors.
- Remove the bench seat. Refer to ➔ Body Interior; Rep. Gr. 72 ; Rear Seats; Rear Bench Seat, Removing and Installing .
- Remove the cover -1- from the fuel delivery unit. The arrow -2- points in direction of travel.





- Make sure the connector -arrow- is secure. Pull on the connector without pressing the catch. If the connector was not connected correctly, it could cause a fault.
- Pull on the connector.
- Check the contacts on the connector and on the fuel delivery unit for damage.



- Connect the -VAS5565- to the connector and to the fuel delivery unit.
- Connect the -VAG1348/3A- to the -VAS5565- and battery positive (+).
- Operate the -VAG1348/3A- .



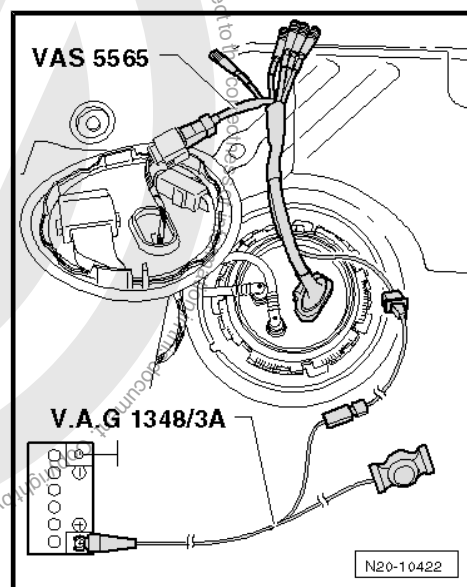
Note

This work step allows the fuel pump to run when the engine is not running.

- Check injectors for leaks (visual inspection).
- Only 1 to 2 drops per minute may emit from each valve when fuel pump is running.

If the fuel loss is greater:

- Disconnect connection to battery plus (+) and replace leaking fuel injector. Refer to
 ⇒ ["2.2 Fuel Injectors, Removing and Installing", page 123](#) .



Injection Quantity, Checking

- The fuel pressure must be OK. Refer to
 ⇒ ["5.1 Fuel Pressure Sensor, Checking", page 133](#) .
- Fuel rail removed.
- Fuel injectors installed in fuel rail and fuel line connected.
- Fuel pump runs (connected to battery with adapter cables).
- Insert the fuel injector to be checked in a measuring glass from the -VAG1602- .

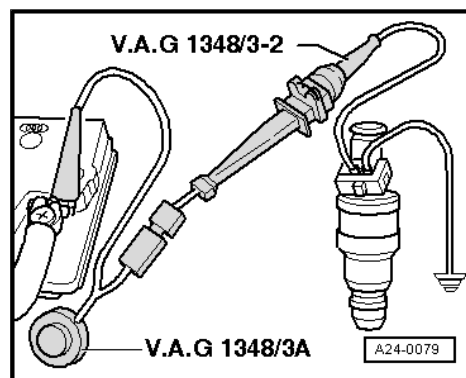


- Using adapter cables from the -VAG1594D-, connect one terminal of the fuel injector to be checked to the engine ground.
- Connect the second terminal of the fuel injector to the -VAG1348/3A- using the -VAG1348/3-2- .
- Connect the alligator clip to the battery positive (+) .
- Operate the -VAG1348/3A- for 30 seconds.
- Repeat the test on the other fuel injectors. Use new graduated measuring glasses for this.
- After all fuel injectors have been activated, place graduated measuring glasses on a level surface and compare quantity of injected fuel.
- Specified value: 85 to 105 mL (2.87 to 3.55 ounce) per valve

Check the spray pattern when checking the injection quantity.
Spray pattern must be the same for all fuel injectors.

If the measured value of one or more fuel injectors is below or above the indicated specified value:

- Replace faulty fuel injector. Refer to
⇒ ["2.2 Fuel Injectors, Removing and Installing", page 123](#) .





3 Air Filter

⇒ [“3.1 Overview - Air Filter Housing”, page 127](#)

3.1 Overview - Air Filter Housing



Note

The components -1 through 4- are the air intake connection. It is attached to the lock carrier.

1 - Air Guide Channel

- ☐ On the lock carrier

2 - Screw

- ☐ 2.5 Nm

3 - Air Funnel

4 - Slider

5 - To the Intake Manifold

- ☐ -Item 16-
⇒ [Item 16 \(page 130\)](#)

6 - To the Cylinder Head Cover

- ☐ -Item 2-
⇒ [Item 2 \(page 52\)](#)

7 - To the Intake Manifold

- ☐ -Item 5-
⇒ [Item 5 \(page 129\)](#)

8 - Positive Crankcase Ventilation Heating Element - N79-

9 - Suction Hose

- ☐ With crankcase bleeder valve and molded hose

10 - Screw

- ☐ 2 Nm

11 - Air Guide

12 - Screw

- ☐ 2 Nm

13 - Clip

14 - Screw

- ☐ 8 Nm

15 - Screw

- ☐ 2 Nm

16 - Air Filter Upper Section

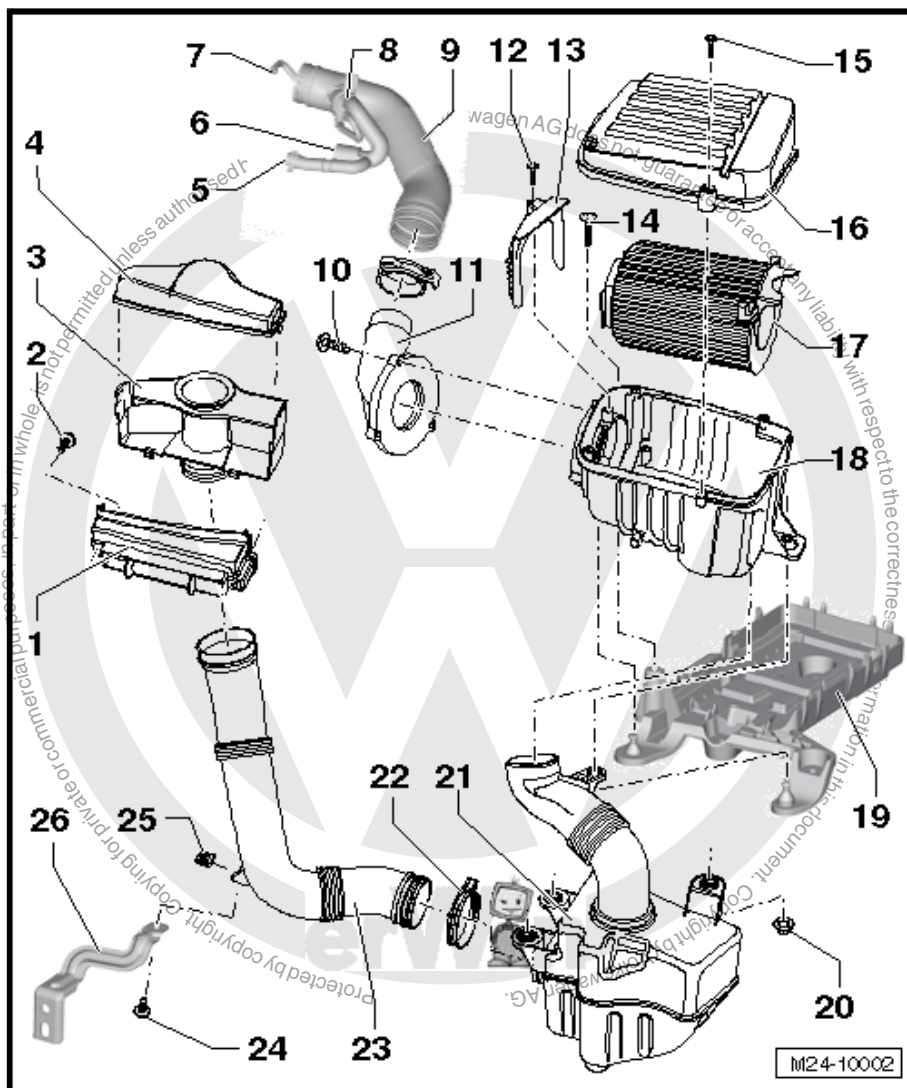
17 - Filter

18 - Air Filter Upper Section

19 - Battery Mount

20 - Screw

- ☐ 20 Nm





21 - Pre-Reservoir

22 - Spring Clamp

23 - Connecting Pipe

24 - Screw

- ☐ 2 Nm

25 - Spring Nut

26 - Mount

- ☐ Attached to the air shroud -item 16- ➔ [Item 16 \(page 112\)](#)





4 Intake Manifold

⇒ [“4.1 Overview - Intake Manifold”, page 129](#)

⇒ [“4.2 Overview - Intake Manifold Lower Section with Fuel Rail”, page 130](#)

⇒ [“4.3 Intake Manifold with Fuel Rail, Removing and Installing”, page 131](#)

4.1 Overview - Intake Manifold

1 - Screw

- ☐ 23 Nm

2 - Intake Manifold

- ☐ One part
- ☐ Intake manifold with fuel rail, removing and installing. Refer to ⇒ [“4.3 Intake Manifold with Fuel Rail, Removing and Installing”, page 131](#)

3 - Manifold Absolute Pressure Sensor - G71-

- ☐ With Manifold Absolute Pressure Sensor - G71-

4 - Screw

- ☐ 2.5 Nm

5 - Connection

- ☐ For the hose to the intake hose - item 7- ⇒ [Item 7 \(page 127\)](#)

6 - Connection

- ☐ For the hose to the brake booster

7 - Rubber Bushing

8 - EVAP Canister Purge Regulator Valve 1 - N80-

9 - Throttle Valve Control Module - J338-

- ☐ With EPC Throttle Drive - G186-, EPC Throttle Drive Angle Sensor 1 - G187- and EPC Throttle Drive Angle Sensor 2 - G188-

- ☐ When replacing, erase the adaptation values and adapt the engine control module to the throttle valve control module using the Vehicle Diagnostic Tester in “Guided Functions”.

10 - Seal

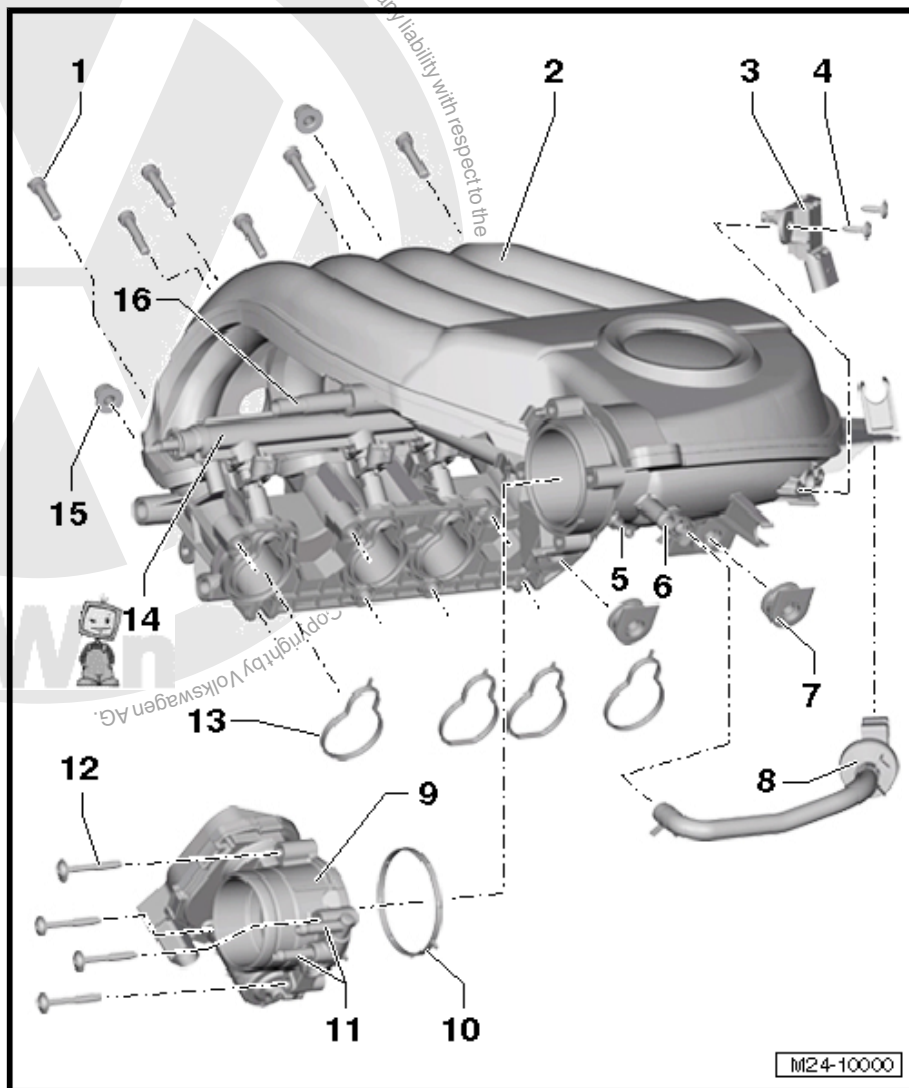
- ☐ Replace if damaged

11 - Connections for Coolant Hoses

- ☐ Refer to ⇒ [“1.1 Connection Diagram - Coolant Hoses”, page 99](#)

12 - Screw

- ☐ 9 Nm





13 - Seal

- ☐ Replace after removing

14 - Fuel Rail

- ☐ Overview. Refer to ➤ [“4.2 Overview - Intake Manifold Lower Section with Fuel Rail”, page 130](#) .

15 - Screw

- ☐ 23 Nm

16 - Connection

- ☐ For the intake hose -item 5- ➤ [Item 5 \(page 127\)](#)

4.2 Overview - Intake Manifold Lower Section with Fuel Rail

1 - Intake Manifold

2 - Wiring Harness

- ☐ For fuel injectors

3 - O-ring

- ☐ Replace after removing
- ☐ Coat with clean engine oil

4 - Cylinder 1 through 4 Fuel Injectors - N30, N31, N32 and N33-

- ☐ Removing and installing. Refer to ➤ [“2.2 Fuel Injectors, Removing and Installing”, page 123](#) .
- ☐ Checking. Refer to ➤ [“2.3 Fuel Injectors, Checking”, page 124](#) .

5 - Bleeder Valve

- ☐ No replacement part, complete with fuel rail

6 - Protective Cap

7 - Clip

- ☐ No replacement part, complete with fuel rail
- ☐ Make sure it is secure

8 - Fuel Rail

- ☐ Fuel rail and fuel injectors, removing and installing. Refer to ➤ [“2.1 Fuel Rail, Removing and Installing”, page 122](#)

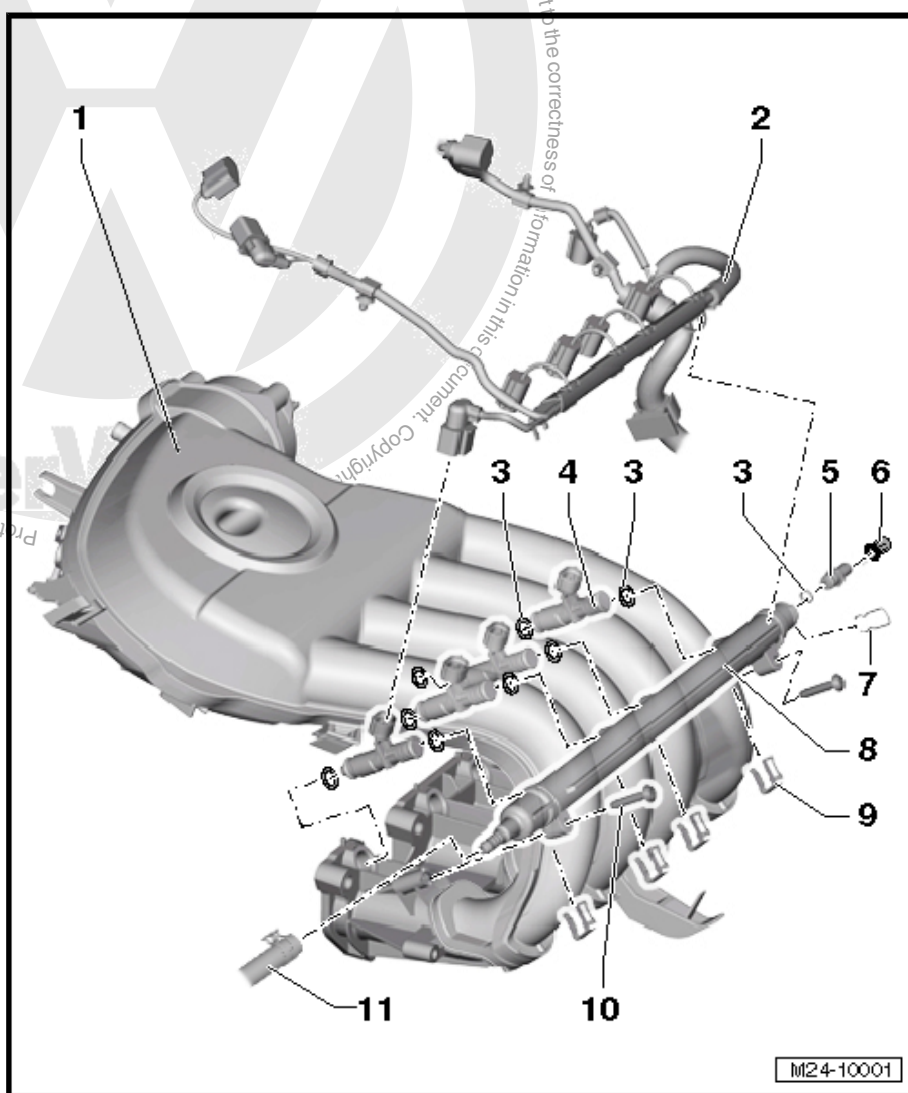
9 - Clip

- ☐ Make sure clip is correctly seated on fuel injector and fuel distributor

10 - Screw

- ☐ 9 Nm

11 - Fuel Supply Line





4.3 Intake Manifold with Fuel Rail, Removing and Installing

Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Hose Clamps - Up To 25 mm - 3094-

Removing



Note

- ◆ Follow all safety precautions. Refer to ⇒ ["1 Safety Precautions", page 1](#).
- ◆ Follow the guidelines for clean working conditions. Refer to ⇒ ["3.1 Clean Working Conditions", page 6](#).
- First find out if a encoded radio is installed. If it is, get the anti-theft code.
- Disconnect the battery. Refer to ► Electrical Equipment; Rep. Gr. 27 ; Battery; Battery, Disconnecting and Connecting .

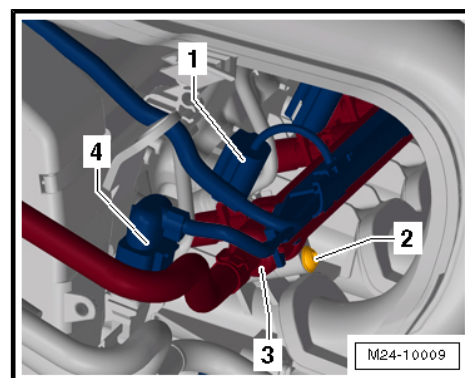
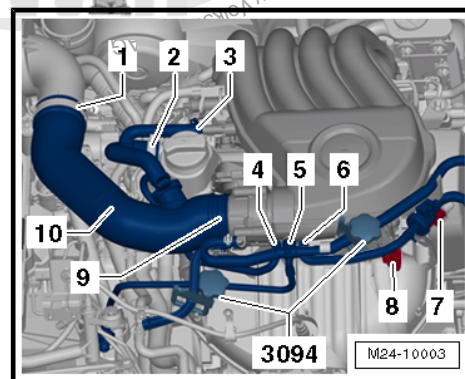


WARNING

Fuel system is under pressure!

- ◆ Wear protective eyewear and protective clothing in order to avoid injury and contact with the skin.
- ◆ Wrap a cloth around the wiring connections before loosening hose connections. Then release pressure by carefully pulling off the line.

- Disconnect the connectors -7- and -8-.
- Disconnect the hoses -4, 5 and 6- from the intake manifold.
- Open clamps -1, 2, 3 and 9- and remove intake hose -10-.
- Clamp off the coolant hoses leading to the throttle valve control module using the -3094- and remove them from the throttle valve control module.
- Remove the cable guide from the fuel rail.
- Disconnect the connector -1- for the fuel injectors and the connector -4- for the Camshaft Position Sensor - G40- .

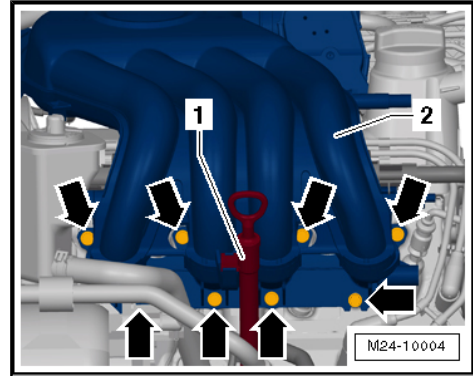




- Remove the oil dipstick tube -1- from the intake manifold -2-.
- Remove the bolts and nuts -arrows-.
- Pull the intake manifold -2- forward and out of the rear rubber bushings.
- Remove the intake manifold with the fuel rail and throttle valve control module.
- Plug the intake ports of the cylinder head with clean cloths.

If the intake manifold is replaced:

- Remove the fuel rail with the fuel injectors. Refer to [⇒ "2.2 Fuel Injectors, Removing and Installing", page 123](#) .
- Remove the throttle valve control module and Manifold Absolute Pressure Sensor - G71- with the Manifold Absolute Pressure Sensor - G71- . Refer to [⇒ "4.1 Overview - Intake Manifold", page 129](#) .



Installing

Install in reverse order of removal. Pay attention to the following:

- ◆ Replace sealing rings between intake manifold and cylinder head.
- ◆ Tighten bolts for intake manifold starting inside working toward outside and in diagonal sequence.
- Connect the battery. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery, Disconnecting and Connecting .
- Fuel system, bleeding. Refer to [⇒ "1.2 Fuel System, Filling/Bleeding", page 119](#) .
- Erase the adaptation values and adapt the engine control module to the throttle valve control module using the Vehicle Diagnostic Tester in "Guided Functions".

Tightening Specifications

- ◆ Refer to [⇒ "4.1 Overview - Intake Manifold", page 129](#)



5 Sensors

⇒ **"5.1 Fuel Pressure Sensor, Checking", page 133**

5.1 Fuel Pressure Sensor, Checking

Special tools and workshop equipment required

- ◆ Pressure Tester Kit - VAS6550-
- ◆ Pressure Tester Kit - Hose 1 - VAS6550/1-
- ◆ Pressure Tester Kit - Hose 2 - VAS6550/2-

Perform the Following Work

- The fuel pump function was checked. Refer to ⇒ Fuel Supply System; Rep. Gr. 20 .



Note

- ◆ *The fuel pressure regulator regulates the fuel pressure to approximately 4 bar (58 psi).*
- ◆ *The fuel pressure regulator is located on the fuel filter.*
- ◆ *Follow all safety precautions. Refer to ⇒ **"1 Safety Precautions", page 1**.*
- ◆ *Follow the guidelines for clean working conditions. Refer to ⇒ **"3.1 Clean Working Conditions", page 6**.*

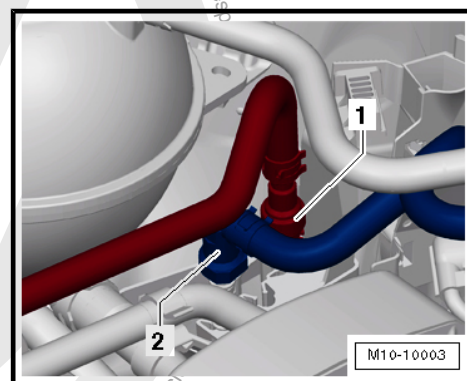


WARNING

Fuel system is under pressure!

- ◆ ***Wear protective eyewear and protective clothing in order to avoid injury and contact with the skin.***
- ◆ ***Wrap a cloth around the wiring connections before loosening hose connections. Then release pressure by carefully pulling off the line.***

- Disconnect the fuel supply line -1-. Push the locking ring upward and into the housing.





- Connect the -VAS6550- to the fuel supply line using the -VAS6550/1- and -VAS6550/2- .
- Make sure the drain is closed and the shut-off valves are open.
- Start the engine and let it run at idle.



Note

If the engine does not start, activate the fuel pump with output diagnostic test mode.

- Read the fuel pressure.
- Specified value: 3.8 to 4.2 bar (55 to 60.91 psi)

If fuel pressure is OK, check residual pressure. Refer to [⇒ page 134](#) .

If the Specification is Exceeded

- Check the fuel return line between the fuel filter and the flange for possible restrictions or blockages.

If no malfunction can be found:

- Replace the fuel filter if the fuel pressure regulator is faulty.

If the Specification is Not Obtained

- Check the fuel lines for possible restrictions (kinks) or blockages.

If no malfunction can be found:

- Replace the fuel filter.
- Repeat the test.

If specified value is again not obtained:

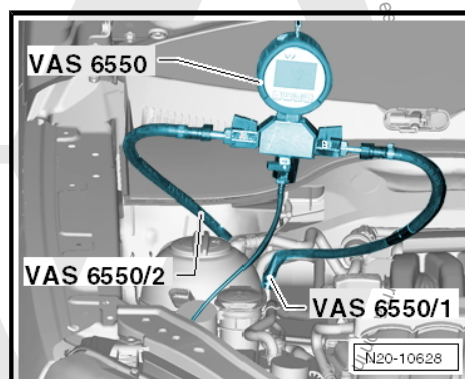
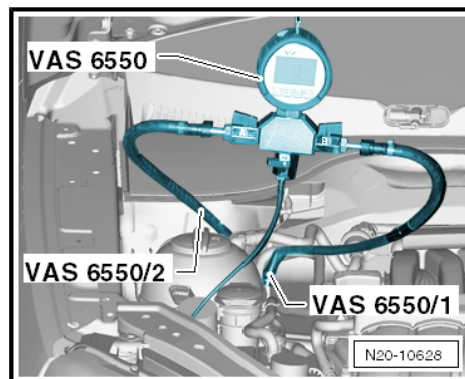
- The fuel pump is defective; Replace the fuel delivery unit. Refer to ⇒ Fuel Supply System; Rep. Gr. 20 ; Fuel Delivery Unit/ Fuel Level Sensor; Fuel Delivery Unit/Fuel Level Sensor, Removing and Installing .

If the Specified Value is Not Reached, Check the Residual Pressure as Follows

- Observe the pressure drop on the pressure gauge.
- The pressure must not drop below 3.0 bar (43.5 psi) after 10 minutes.

If the pressure drops further:

- Start the engine and let it run at idle.





- Switch on the ignition and immediately close cut-off tap -B- of the pressure tester.

If Pressure No Longer Drops Now

Look for leaks on the engine-side. Repeat the residual pressure check. Close the shut-off valve -A- this time to determine if there actually is a leak on the engine side.

- Check the fuel rail and the fuel injectors for leaks.

If the Pressure Drops Again

(Leak on fuel tank side)

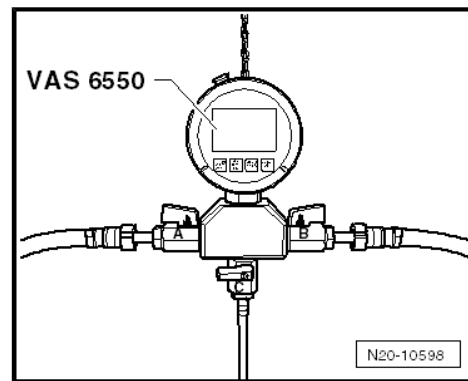
- Check fuel lines for leaks.

If no malfunctions are found in the fuel lines:

- Fuel pump check valve, checking

If no malfunction is found here either:

- Replace the fuel filter.
- Fuel system, bleeding. Refer to
 ⇒ ["1.2 Fuel System, Filling/Bleeding", page 119](#) .





6 Engine Control Module

⇒ "6.1 Engine Control Module, Removing and Installing",
page 136

6.1 Engine Control Module, Removing and Installing

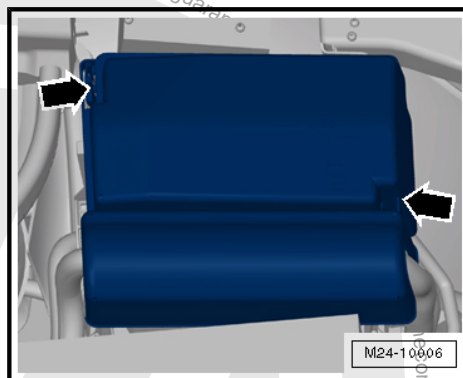


Note

If it is necessary to replace the engine control module, connect the Vehicle Diagnostic Tester and perform "Replace control module" function.

Removing

- Turn off the ignition.
- Remove the E-box cover inside the engine compartment -arrows-.

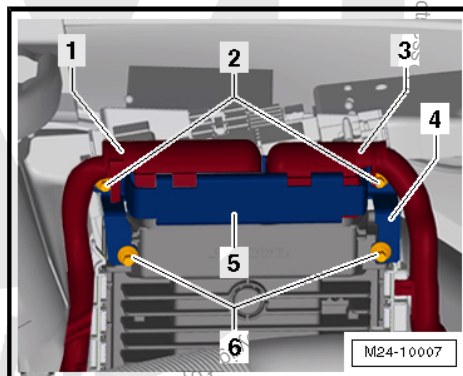


Vehicles with Anti-Theft Protection

- Disconnect the threaded connection -2-.
- Remove the locking mechanism -5-.
- Disconnect the connectors -1 and 3- from the engine control module.

Only if the engine control module is replaced:

- Remove the threaded connections -6- and the bracket -4-.



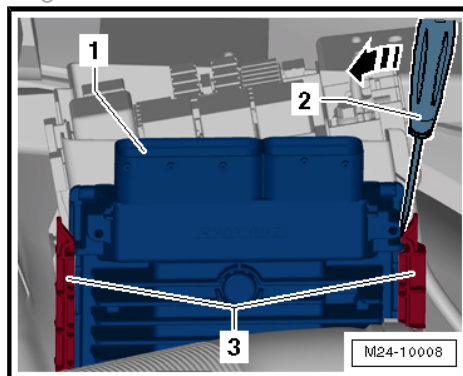
Vehicles without Anti-Theft Protection

- Disconnect the connectors -1 and 3- from the engine control module.

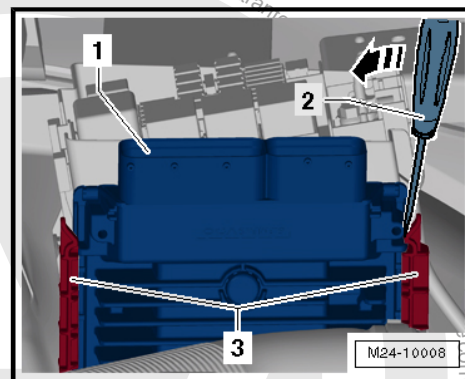
Continuation for All Vehicles

- Push the tabs on the side guides -3- carefully toward the outside with a screwdriver -2-.
- Remove the engine control module -1- from the guides -3-.

Installing

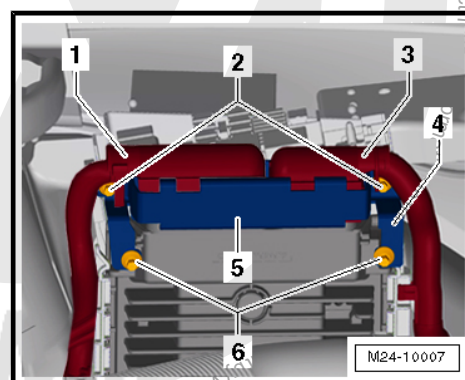


- Install the engine control module -1- into the guides -3- until it locks.



Vehicles with Anti-Theft Protection

- Attach the bracket -4- to the engine control module with the shear bolts -6-.
- Tighten the shear bolts -6- just enough until the bolt head breaks off.
- Connect the connectors -1 and 3- to the engine control module.
- Install the locking mechanism -5- with shear bolts -2-.
- Tighten the shear bolts -2- until the bolt heads break off.



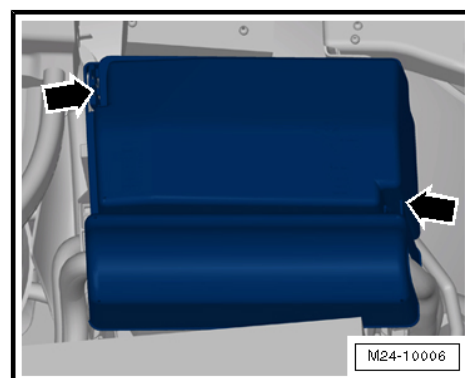
Vehicles Without Anti-Theft Protection

- Connect the connectors -1 and 3- to the engine control module.

Continuation for All Vehicles

- Install the E-box cover -arrows-.

Engine Control Module DTC Memory, Checking and Erasing



Special tools and workshop equipment required

- ◆ Vehicle Diagnostic Tester

Perform the Following Work

- Connect the Vehicle Diagnostic Tester -1-.
- Connect the diagnostic cable connector -2- to the diagnostic connection inside the footwell on the driver side.
- Start the engine and let it run at idle.

Only if engine does not start:

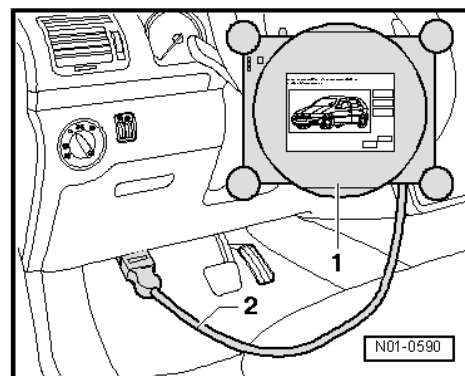
- Turn on the ignition.

Selecting Operating Mode

- Press “OBD” on the touch screen.

Selecting Vehicle System

- Press the “01 - engine electronics” button on the display.






The control module identification with coding -2- as well as Vehicle Identification Number (VIN) in center area and identification of anti-theft immobilizer appear on the display.



Note

A printout is available if needed. Press the "print" button.

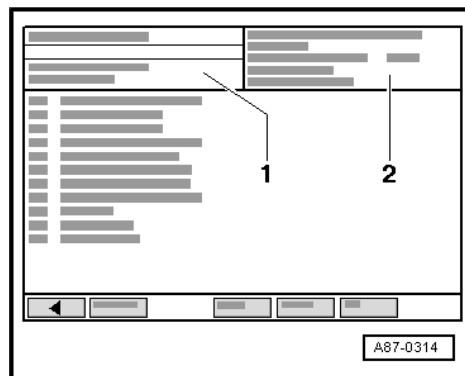
Selecting Diagnosis Function

- Press "02 - Check DTC memory" on the touch screen.
- If no malfunction is stored in engine control module, "0 errors detected" is displayed.
- If malfunctions are stored in the engine control module, these are shown one below another on the display.
- Press the  button.
- Press "05 - Erase DTC memory" on the touch screen.
- Press "06 - End output".



Note

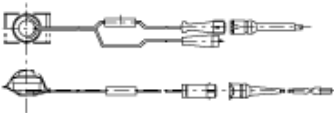


If the DTC memory was erased, the readiness code must be re-generated using the Vehicle Diagnostic Tester in "Guided Fault Finding".



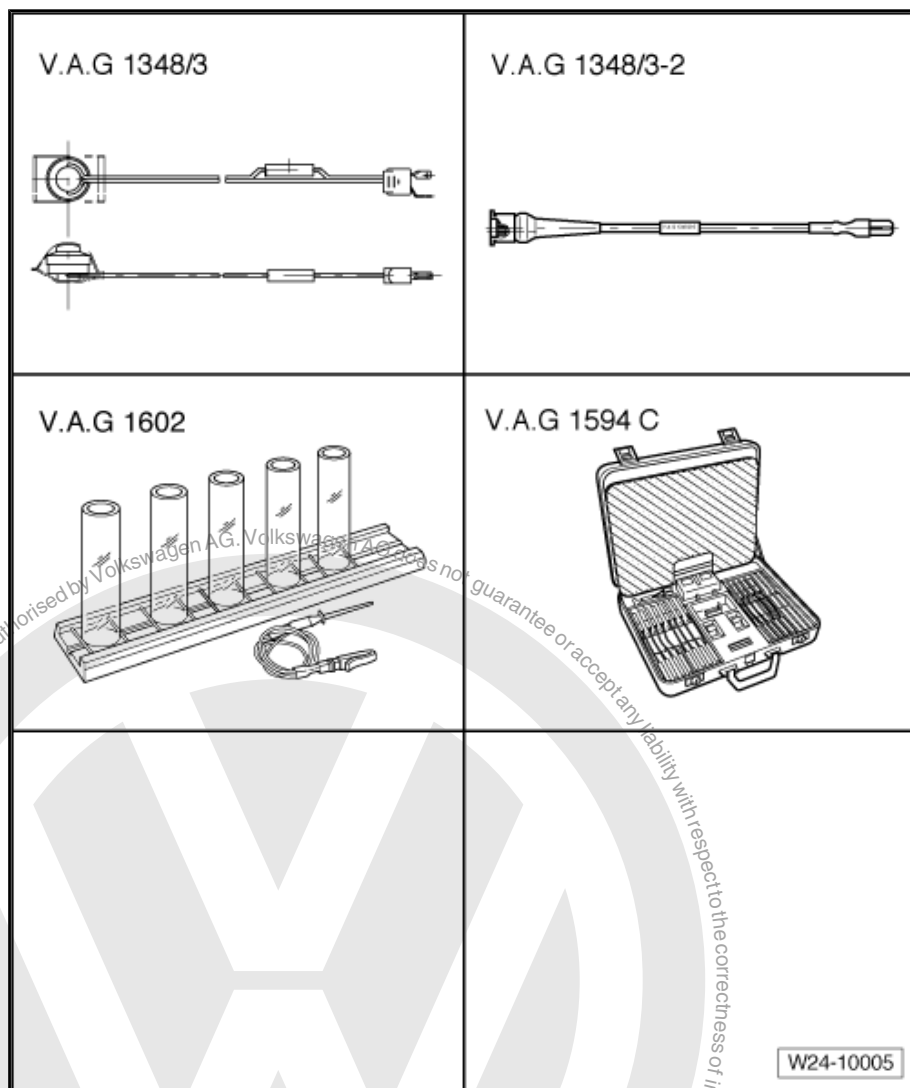


7 Special Tools

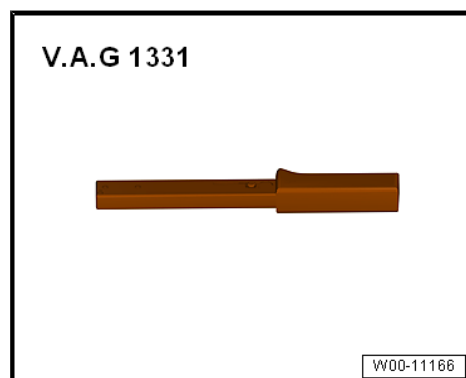
Special tools and workshop equipment required

<p>V.A.G 1348/3A</p> 	<p>V.A.G 1348/3-2</p> 
<p>VAS 5226</p> 	
	<p>W20-0083</p>

- ◆ Injection Rate Comparison Meter Kit - Remote Cable - VAG1348/3A-
- ◆ Injection Rate Comparison Meter Kit - Adapter - VAG1348/3-2-
- ◆ Suction Pump - VAS5226-
- ◆ Fuel Injection Gauge Kit - Fuel Bleeder 20 - VAG1318/20-
- ◆ Adapter - VAG1318/20-1-

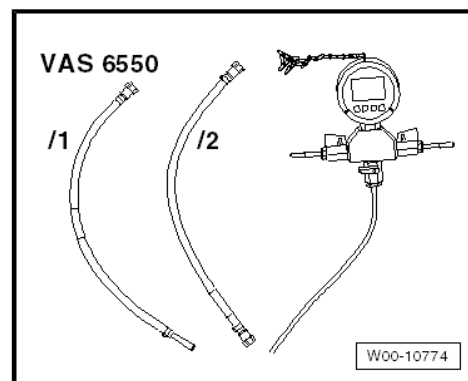


- ◆ Injection Rate Comparison Meter Kit - Remote Cable - VAG1348/3A-
- ◆ Injection Rate Comparison Meter Kit - Adapter - VAG1348/3-2-
- ◆ Injection Rate Tester - VAG1602-
- ◆ Connector Test Set - VAG1594D-
- ◆ Vehicle Diagnostic Tester - Test Adapter, 5 Pin - VAS5565-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-

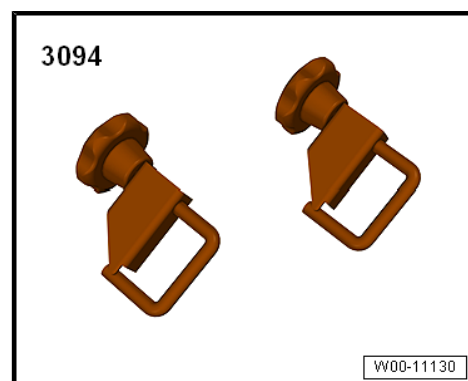




◆ Pressure Tester Kit - VAS6550-



◆ Hose Clamps - Up To 25 mm - 3094-



26 – Exhaust System, Emission Controls

1 Exhaust Pipes/Mufflers

⇒ [“1.1 Overview - Muffler”, page 142](#)

⇒ [“1.2 Exhaust Pipes/Mufflers, Separating”, page 143](#)

⇒ [“1.3 Clamping Sleeve Installation Position”, page 144](#)

⇒ [“1.4 Exhaust System, Installing without Tension”, page 145](#)

1.1 Overview - Muffler

1 - Suspended Mount

2 - Bolt

- ☐ 25 Nm

3 - Front Muffler

- ☐ Factory-installed with rear muffler as one unit, to be replaced individually in the event of repairs.
- ☐ Exhaust system, separating. Refer to [⇒ “1.2 Exhaust Pipes/Mufflers, Separating”, page 143](#).
- ☐ Exhaust system, installing without tension. Refer to [⇒ “1.4 Exhaust System, Installing without Tension”, page 145](#).

4 - Retaining Loop

- ☐ Replace if damaged

5 - Repair Clamp

- ☐ For individual replacement of front and rear mufflers
- ☐ Installed position. Refer to [⇒ Fig. “Installation Position of Clamp”, page 143](#)
- ☐ Tighten bolts evenly

6 - Rear Muffler

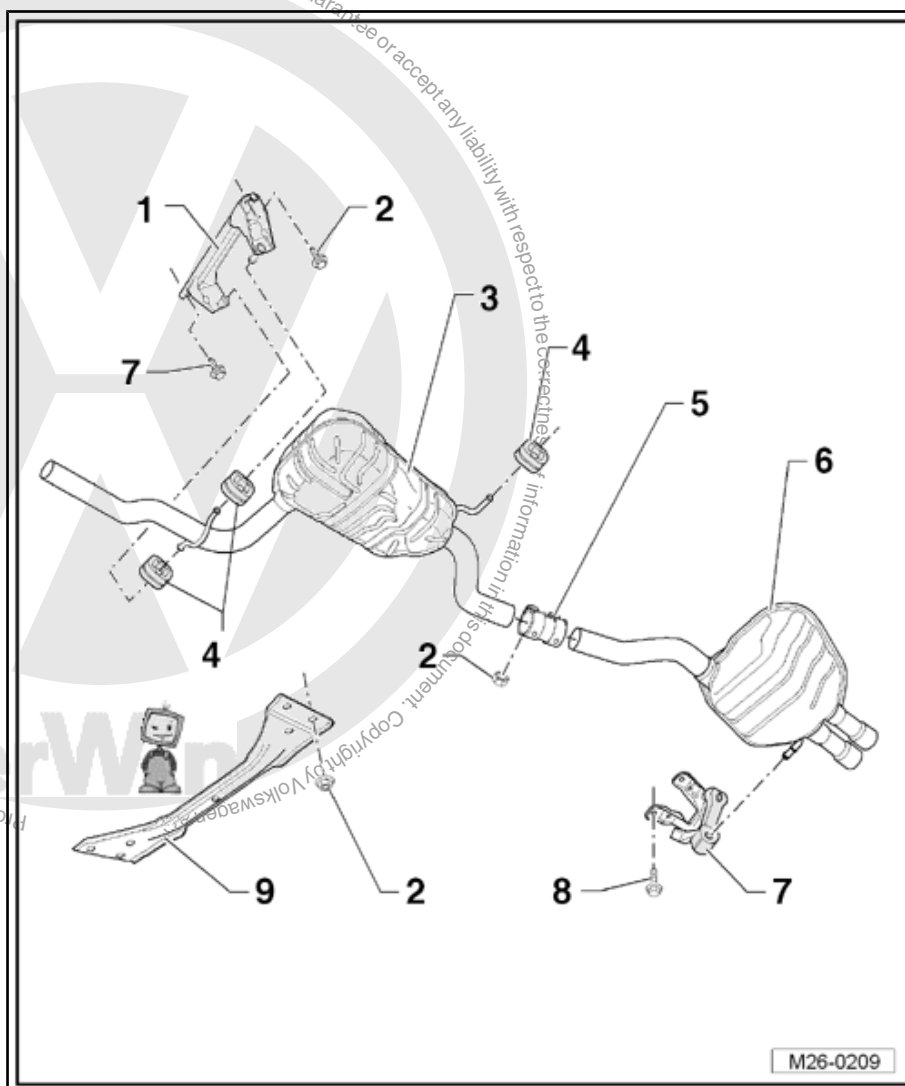
- ☐ Factory-installed with front muffler as one unit, to be replaced individually in the event of repairs.
- ☐ Exhaust system, separating. Refer to [⇒ “1.2 Exhaust Pipes/Mufflers, Separating”, page 143](#).
- ☐ Exhaust system, installing without tension. Refer to [⇒ “1.4 Exhaust System, Installing without Tension”, page 145](#).

7 - Suspended Mount

- ☐ Replace if damaged

8 - Bolt

- ☐ 25 Nm





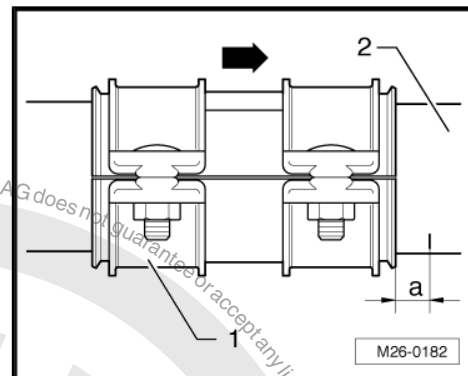
9 - Crossbrace

Installation Position of Clamp

The -arrow- points in the direction of travel.

- Line up the clamp -1- with the marking on intermediate pipe -2-.
- a = 5 mm

Mounting bolts must not project beyond the lower edge of the clamp.



1.2 Exhaust Pipes/Mufflers, Separating

Special tools and workshop equipment required

- ◆ Pneumatic Body Saw - VAS6780- or
- ◆ Chain Pipe Cutter - VAS6254-
- ◆ Protective eyewear
- ◆ A separating point has been provided in the connecting pipe for individual replacement of the front or rear muffler.
- ◆ The separating point is marked by depressions around the circumference of the exhaust pipe.

Separating



WARNING

To prevent injuries from metal shavings, wear protective goggles and protective clothing.

- Cut the exhaust pipe at a right angle at the separating point -arrow 2-, for example using a -VAS6780- or -VAS6254- .

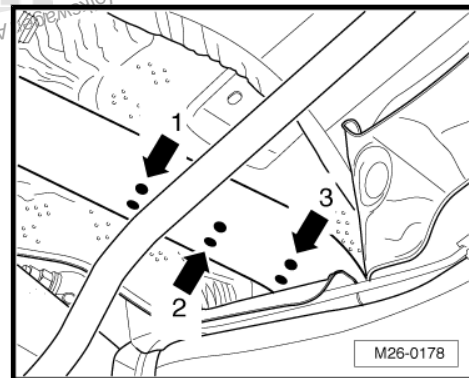
Joining



Note

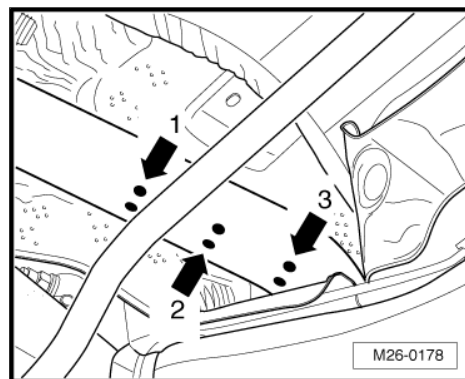
A second mechanic is required for installing the repair clamping sleeve.

- Secure the front muffler in the mounts. The front clamp remains loosely connected to pipes.
- Align the rear muffler horizontally and hold it in this position.





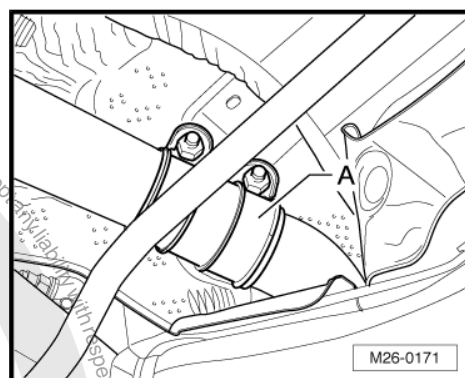
- Position the repair clamp flush at the markings -arrow 1- and -arrow 3-.



- Turn the repair clamp -A- as shown and tighten.
- Align the exhaust system free of tension. Refer to ["1.4 Exhaust System, Installing without Tension", page 145](#).

Tightening Specifications

- ◆ Refer to ["1.1 Overview - Muffler", page 142](#)



1.3 Clamping Sleeve Installation Position



Note

Gradual introduction of clamping sleeves with continuous clamp.

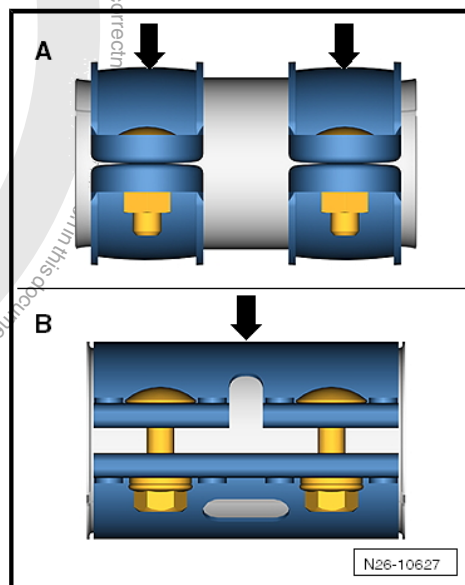
Installed Dimension of Clamping Sleeve

Clamping sleeve -A- with two individual clamps.

Installation dimension -a- 5 mm (only for front clamping sleeve)

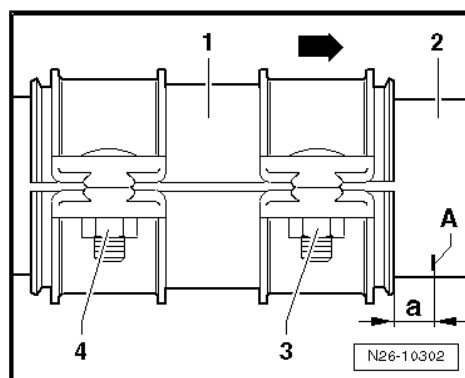
Clamping sleeve -B- with continuous clamp.

Installation dimension -a- 8.5 mm (only for front clamping sleeve)



Installation Dimension -a- for Vehicles With Marking on the Front Exhaust Pipe

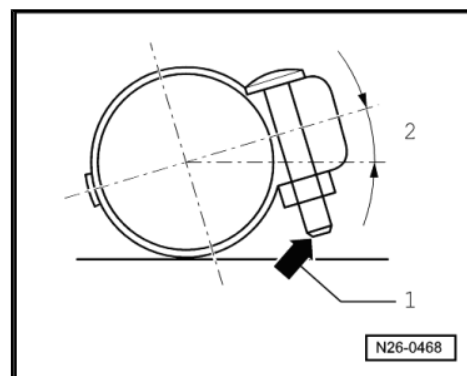
- 1 - Clamping sleeve
- 2 - Front exhaust pipe
- a - Installed dimension
- A - Marking





Installed Position of Front Clamping Sleeve

- Install the clamping sleeve so that the bolt end -arrow- does not project beyond the lower edge of clamping sleeve.
- Threaded connection points toward the right.

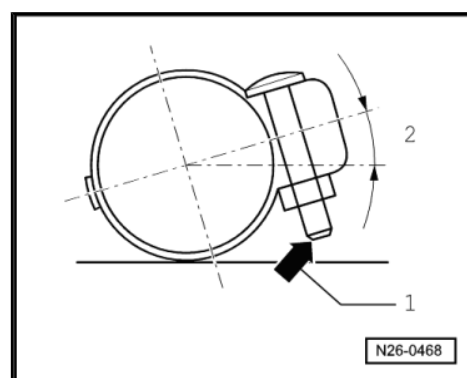


Installed Position of Rear Clamping Sleeve

- Install the clamping sleeve so that the bolt end -arrow- does not project beyond the lower edge of clamping sleeve.
- Threaded connection points to the rear

Tightening Specifications

- ◆ Refer to ["1.1 Overview - Muffler", page 142](#)



1.4 Exhaust System, Installing without Tension

Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm - VAG1331

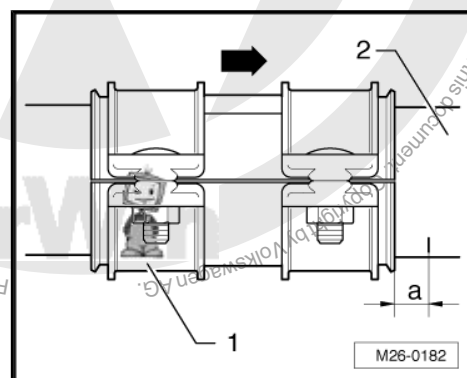


Note

- ◆ *After exhaust system repairs, make sure exhaust system is not under stress and is far enough from the body. If necessary, loosen the clamping sleeve and align the muffler and front exhaust pipe so that there is enough clearance all the way around. The suspended mounts must be loaded evenly.*
- ◆ *Replace seals and self-locking nuts.*
- Exhaust system must be aligned when it is cool.

Perform the Following Work

- Loosen the threaded connection on the front clamping sleeve -1-.
- The -arrow- points in the direction of travel.
- Position the front clamping sleeve so that the dimension -a- for the marking on the pipe -2- is 5 mm.
- Tighten the front clamping sleeve hand-tight.





- Push the exhaust system as far forward until the dimension -a- on the outer retaining loop of the front muffler is 9 to 11 mm.

The -arrow- points in the direction of travel.

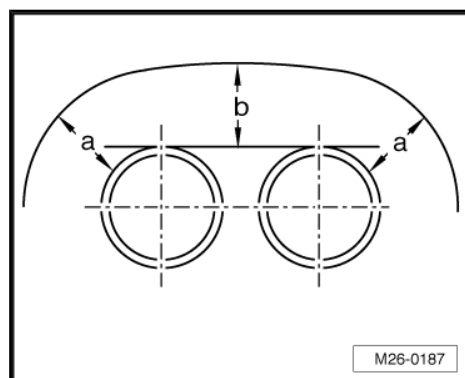
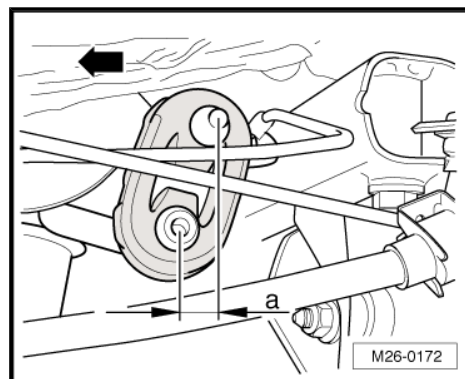
- Tighten the front clamping sleeve evenly in this position.

Tail Pipes, Aligning

- Align the rear muffler.
- The distance -a- between the bumper opening and the tail pipe must be equal on the right and left sides.
- The distance -b- from the bumper opening to the tail pipes must run parallel.
- Loosen the rear muffler mount to align the tail pipe.

Tightening Specifications

- ◆ Refer to ➔ [“1.1 Overview - Muffler”, page 142](#)





2 Emissions Control

⇒ **"2.1 Overview - Emissions Control", page 147**

2.1 Overview - Emissions Control

1 - Warm Air Collector Plate

2 - Heated Oxygen Sensor - G39-

- ☐ 50 Nm
- ☐ Removing and installing with Ring Wrench 7-Piece Set - 3337-
- ☐ Coat the threads on the new heated oxygen sensors with assembly paste.
- ☐ When reusing a heated oxygen sensor, only use Hot Bolt Paste to grease the thread. Do not let paste get onto slits on the heated oxygen sensor body
- ☐ If sealing ring is leaking cut open and replace.
- ☐ Installed location of the connector: inside the engine compartment on the bulkhead -item 14- ⇒ **Item 14 (page 119)**

3 - Bolt

- ☐ 23 Nm

4 - Bolt

- ☐ 10 Nm

5 - Nut

- ☐ 23 Nm
- ☐ Replace after removing

6 - Exhaust Manifold

- ☐ Coat stud bolts with Hot Bolt Paste

7 - Gasket

- ☐ Replace after removing

8 - Gasket

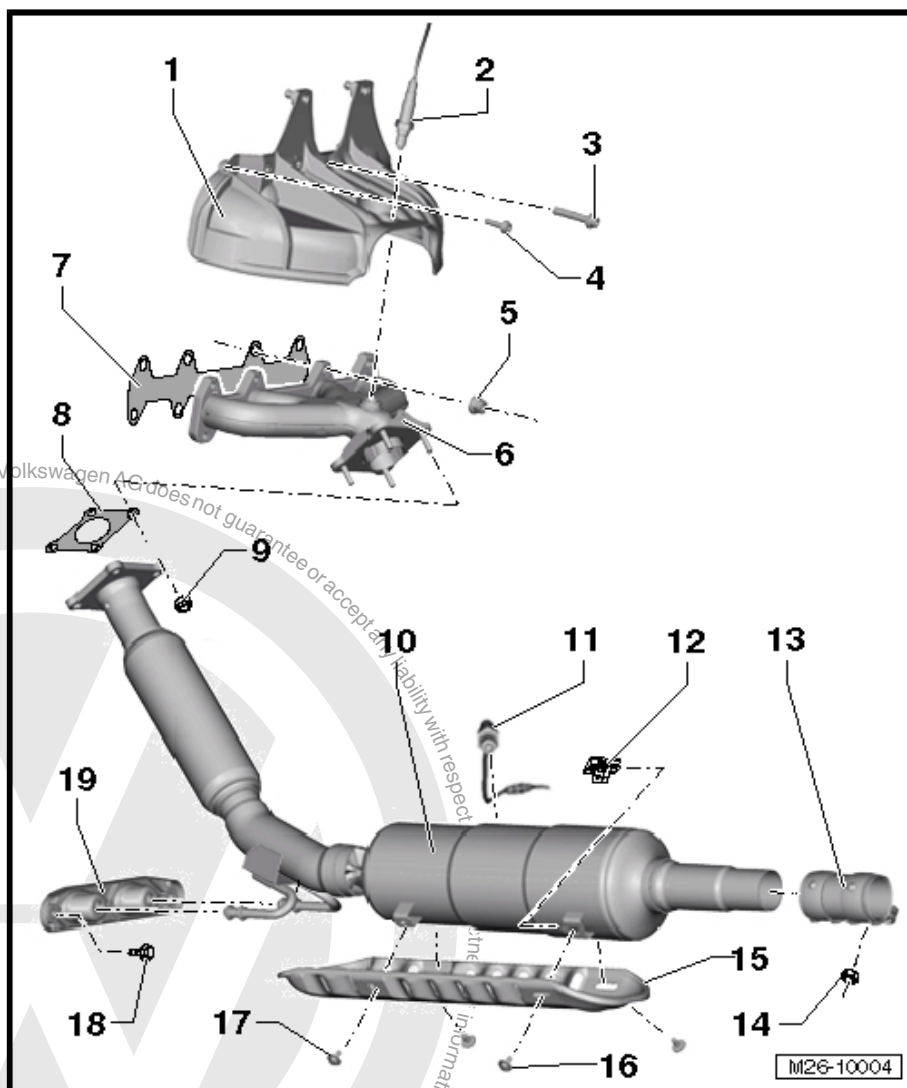
- ☐ Replace after removing

9 - Nut

- ☐ 23 Nm
- ☐ Replace after removing

10 - Front Exhaust Pipe

- ☐ With catalytic converter
- ☐ Protect from shocks and impact stress
- ☐ With decoupling element
- ☐ Do not bend the decoupling element more than 10° - otherwise it may get damaged





- ☐ Exhaust system, installing without tension. Refer to
⇒ [“1.4 Exhaust System, Installing without Tension”, page 145](#) .
- ☐ Installed location of the connector: inside the engine compartment on the bulkhead -item 14-
⇒ [Item 14 \(page 119\)](#)

11 - Oxygen Sensor after Three Way Catalytic Converter - G130-

- ☐ 55 Nm
- ☐ Removing and installing with Ring Wrench 7-Piece Set - 3337-
- ☐ Coat the threads on the new heated oxygen sensors with assembly paste.
- ☐ When reusing a heated oxygen sensor, only use Hot Bolt Paste to grease the thread. Do not let paste get onto slits on the heated oxygen sensor body
- ☐ If sealing ring is leaking cut open and replace.

12 - Spring Nut

- ☐ Insert from front

13 - Front Clamping Sleeve

- ☐ Before tightening, ensure exhaust system is tension-free. Refer to
⇒ [“1.4 Exhaust System, Installing without Tension”, page 145](#)
- ☐ Installed position. Refer to ⇒ [Fig. “Installed Position of Front Clamping Sleeve””, page 149](#)
- ☐ Tighten bolts evenly

14 - Nut

- ☐ 23 Nm

15 - Heat Shield

- ☐ For catalytic converter

16 - Bolt

- ☐ 5 Nm

17 - Bolt

- ☐ 10 Nm

18 - Bolt

- ☐ 23 Nm

19 - Suspended Mount

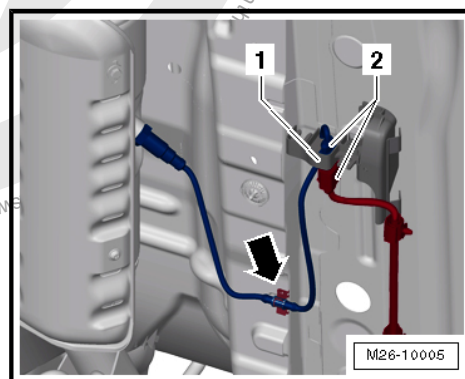
- ☐ Replace if damaged

Connector for Oxygen Sensor after Three Way Catalytic Converter - G130-

The connector is located to the right, on the vehicle floor under the cover.

- 1 - Mount
- 2 - Connector for Oxygen Sensor after Three Way Catalytic Converter - G130- , brown

The Oxygen Sensor after Three Way Catalytic Converter - G130- cable is held in place with a clip -arrow-.

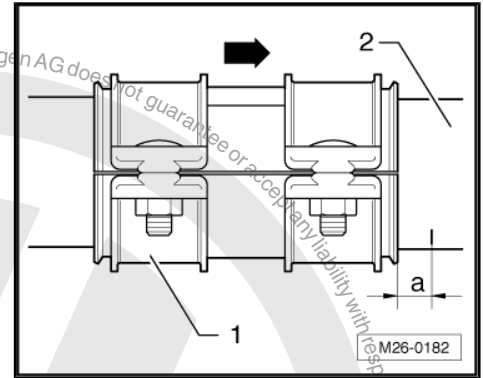




Installed Position of Front Clamping Sleeve

The -arrow- points in the direction of travel.

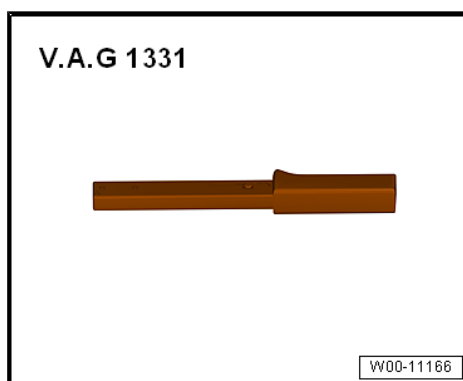
- Line up the front clamping sleeve -1- with the marking on the catalytic converter -2-.
- a- = 5 mm
- The bolts must be at the right and must not project beyond the lower edge of the clamping sleeve.



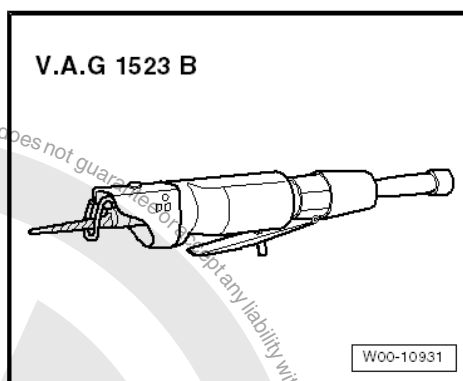


3 Special Tools

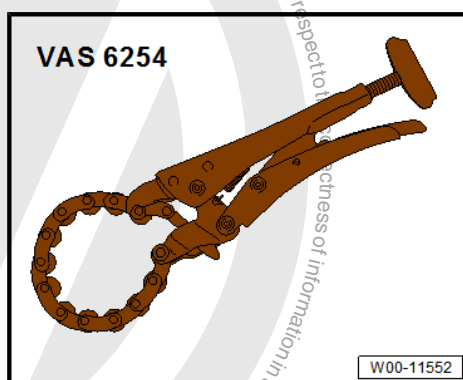
Torque Wrench 1331 5-50Nm - VAG1331-



Pneumatic Body Saw - VAS6780- or



Chain Pipe Cutter - VAS6254-





28 – Ignition/Glow Plug System

1 Ignition System

⇒ [“1.1 Overview - Ignition System”, page 151](#)

⇒ [“1.2 Test Data and Spark Plugs”, page 152](#)

1.1 Overview - Ignition System

1 - Bolt

- ☐ 10 Nm

2 - Spark Plug Wire

- ☐ With interference suppression connector and spark plug connector
- ☐ Only remove and install spark plug connectors using the Puller - Spark Plug Connector - T10112-

3 - Spark Plug

- ☐ 25 Nm
- ☐ Remove and install with Spark Plug Removal Tool - 3122B-
- ☐ Type and electrode gap. Refer to
 ⇒ [“1.2 Test Data and Spark Plugs”, page 152](#)

4 - Bolt

- ☐ 20 Nm
- ☐ Tightening specifications affect function of knock sensor

5 - Knock Sensor 1 - G61-

- ☐ Contacts gold plated

6 - Connector

- ☐ Black, 2-pin
- ☐ Contacts gold plated

7 - Camshaft Position Sensor - G40-

- ☐ Component locations overview. Refer to
 ⇒ [“1.1 Component Location Overview - Fuel Injection System”, page 118](#)

8 - Connector

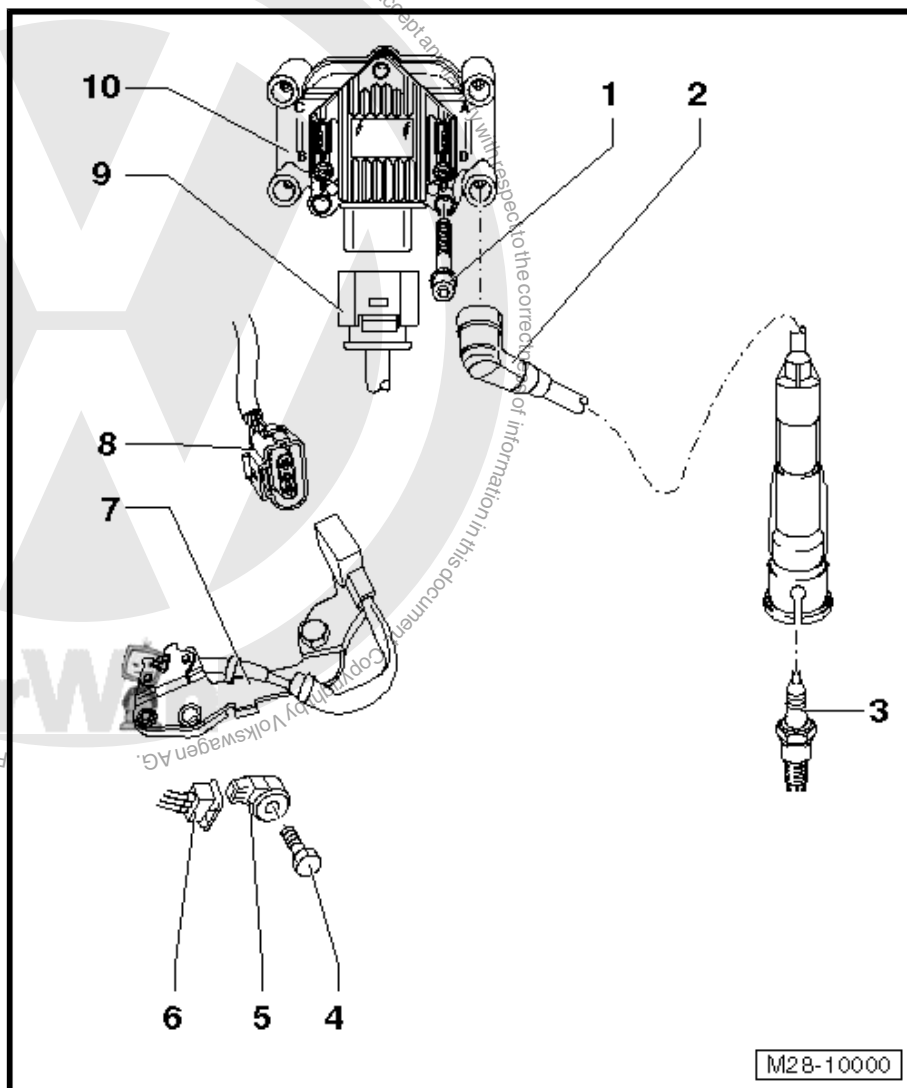
- ☐ Black, 3-pin
- ☐ For Camshaft Position Sensor - G40-

9 - Connector

- ☐ For the ignition coil

10 - Ignition Coil

- ☐ With Ignition Coil 1 - N- and Ignition Coil 2 - N128- with Power Output Stage - N122-





- ❑ Component locations overview. Refer to
⇒ [“1.1 Component Location Overview - Fuel Injection System”, page 118](#)

- ❑ Ignition wire connection

- ◆ A = Cylinder 1
- ◆ B = Cylinder 3
- ◆ C = Cylinder 2
- ◆ D = Cylinder 4

1.2 Test Data and Spark Plugs

Engine code	CBPA	CKJA
Ignition sequence	1-3-4-2	1-3-4-2
Spark plugs	Refer to the ⇒ Electronic Parts Catalog (ETKA) .	
Electrode gap	0.9 to 1.1 mm	0.8 to 0.9 mm
Tightening Specification	25 Nm	25 Nm
Change intervals	Refer to ⇒ Maintenance ; Book-let ; Maintenance Tables .	Refer to ⇒ Maintenance ; Book-let ; Maintenance Tables .



2 Revision History

DRUCK NUMBER: K0059071621

Factory Edition	Edit Edition	Job Type	Feedback	Notes	Quality Checked By
12.2 015	12/1 1/20 18	Correction		MRP removal process	Tom Perry
12.2 015	1/8/2 016	Factory Update		Add MRPs and delete tool names from text.	Jim H
10.2 014	12/0 5/20 14	Factory Update and Local Feedback	10 63 86 0	For feedback: Deleted p/n for spark plugs replace w/ refer to the parts catalog per factory.	Eric P



Cautions & Warnings

Please read these WARNINGS and CAUTIONS before proceeding with maintenance and repair work. You must answer that you have read and you understand these WARNINGS and CAUTIONS before you will be allowed to view this information.

- If you lack the skills, tools and equipment, or a suitable workshop for any procedure described in this manual, we suggest you leave such repairs to an authorized Volkswagen retailer or other qualified shop. We especially urge you to consult an authorized Volkswagen retailer before beginning repairs on any vehicle that may still be covered wholly or in part by any of the extensive warranties issued by Volkswagen.
- Disconnect the battery negative terminal (ground strap) whenever you work on the fuel system or the electrical system. Do not smoke or work near heaters or other fire hazards. Keep an approved fire extinguisher handy.
- Volkswagen is constantly improving its vehicles and sometimes these changes, both in parts and specifications, are made applicable to earlier models. Therefore, part numbers listed in this manual are for reference only. Always check with your authorized Volkswagen retailer parts department for the latest information.
- Any time the battery has been disconnected on an automatic transmission vehicle, it will be necessary to reestablish Transmission Control Module (TCM) basic settings using the VAG 1551 Scan Tool (ST).
- Never work under a lifted vehicle unless it is solidly supported on stands designed for the purpose. Do not support a vehicle on cinder blocks, hollow tiles or other props that may crumble under continuous load. Never work under a vehicle that is supported solely by a jack. Never work under the vehicle while the engine is running.
- For vehicles equipped with an anti-theft radio, be sure of the correct radio activation code before disconnecting the battery or removing the radio. If the wrong code is entered when the power is restored, the radio may lock up and become inoperable, even if the correct code is used in a later attempt.
- If you are going to work under a vehicle on the ground, make sure that the ground is level. Block the wheels to keep the vehicle from rolling. Disconnect the battery negative terminal (ground strap) to prevent others from starting the vehicle while you are under it.
- Do not attempt to work on your vehicle if you do not feel well. You increase the danger of injury to yourself and others if you are tired, upset or have taken medicine or any other substances that may impair you or keep you from being fully alert.
- Never run the engine unless the work area is well ventilated. Carbon monoxide (CO) kills.
- Always observe good workshop practices. Wear goggles when you operate machine tools or work with acid. Wear goggles, gloves and other protective clothing whenever the job requires working with harmful substances.
- Tie long hair behind your head. Do not wear a necktie, a scarf, loose clothing, or a necklace when you work near machine tools or running engines. If your hair, clothing, or jewelry were to get caught in the machinery, severe injury could result.
- Do not re-use any fasteners that are worn or deformed in normal use. Some fasteners are designed to be used only once and are unreliable and may fail if used a second time. This includes, but is not limited to, nuts, bolts, washers, circlips and cotter pins. Always follow the recommendations in this manual - replace these fasteners with new parts where indicated, and any other time it is deemed necessary by inspection.

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- Illuminate the work area adequately but safely. Use a portable safety light for working inside or under the vehicle. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.
- Friction materials such as brake pads and clutch discs may contain asbestos fibers. Do not create dust by grinding, sanding, or by cleaning with compressed air. Avoid breathing asbestos fibers and asbestos dust. Breathing asbestos can cause serious diseases such as asbestosis or cancer, and may result in death.
- Finger rings should be removed so that they cannot cause electrical shorts, get caught in running machinery, or be crushed by heavy parts.
- Before starting a job, make certain that you have all the necessary tools and parts on hand. Read all the instructions thoroughly; do not attempt shortcuts. Use tools that are appropriate to the work and use only replacement parts meeting Volkswagen specifications. Makeshift tools, parts and procedures will not make good repairs.
- Catch draining fuel, oil or brake fluid in suitable containers. Do not use empty food or beverage containers that might mislead someone into drinking from them. Store flammable fluids away from fire hazards. Wipe up spills at once, but do not store the oily rags, which can ignite and burn spontaneously.
- Use pneumatic and electric tools only to loosen threaded parts and fasteners. Never use these tools to tighten fasteners, especially on light alloy parts. Always use a torque wrench to tighten fasteners to the tightening torque listed.
- Keep sparks, lighted matches, and open flame away from the top of the battery. If escaping hydrogen gas is ignited, it will ignite gas trapped in the cells and cause the battery to explode.
- Be mindful of the environment and ecology. Before you drain the crankcase, find out the proper way to dispose of the oil. Do not pour oil onto the ground, down a drain, or into a stream, pond, or lake. Consult local ordinances that govern the disposal of wastes.
- The air-conditioning (A/C) system is filled with a chemical refrigerant that is hazardous. The A/C system should be serviced only by trained automotive service technicians using approved refrigerant recovery/recycling equipment, trained in related safety precautions, and familiar with regulations governing the discharging and disposal of automotive chemical refrigerants.
- Before doing any electrical welding on vehicles equipped with anti-lock brakes (ABS), disconnect the battery negative terminal (ground strap) and the ABS control module connector.
- Do not expose any part of the A/C system to high temperatures such as open flame. Excessive heat will increase system pressure and may cause the system to burst.
- When boost-charging the battery, first remove the fuses for the Engine Control Module (ECM), the Transmission Control Module (TCM), the ABS control module, and the trip computer. In cases where one or more of these components is not separately fused, disconnect the control module connector(s).
- Some of the vehicles covered by this manual are equipped with a supplemental restraint system (SRS), that automatically deploys an airbag in the event of a frontal impact. The airbag is operated by an explosive device. Handled improperly or without adequate safeguards, it can be accidentally activated and cause serious personal injury. To guard against personal injury or airbag system failure, only trained Volkswagen Service technicians should test, disassemble or service the airbag system.

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- Do not quick-charge the battery (for boost starting) for longer than one minute, and do not exceed 16.5 volts at the battery with the boosting cables attached. Wait at least one minute before boosting the battery a second time.
- Never use a test light to conduct electrical tests of the airbag system. The system must only be tested by trained Volkswagen Service technicians using the VAG 1551 Scan Tool (ST) or an approved equivalent. The airbag unit must never be electrically tested while it is not installed in the vehicle.
- Some aerosol tire inflators are highly flammable. Be extremely cautious when repairing a tire that may have been inflated using an aerosol tire inflator. Keep sparks, open flame or other sources of ignition away from the tire repair area. Inflate and deflate the tire at least four times before breaking the bead from the rim. Completely remove the tire from the rim before attempting any repair.
- When driving or riding in an airbag-equipped vehicle, never hold test equipment in your hands or lap while the vehicle is in motion. Objects between you and the airbag can increase the risk of injury in an accident.

I have read and I understand these Cautions and Warnings.